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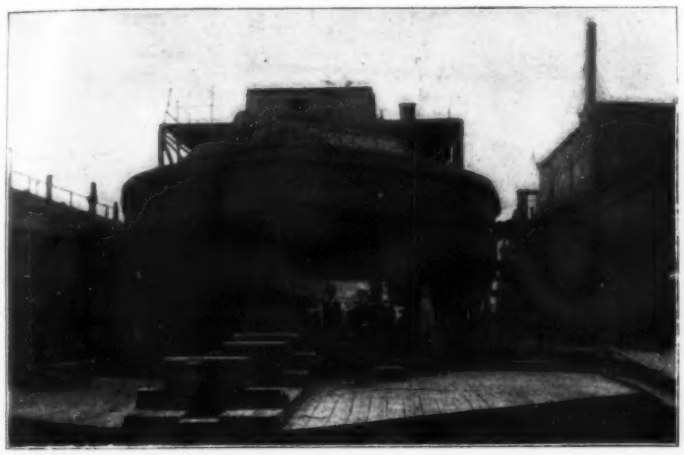
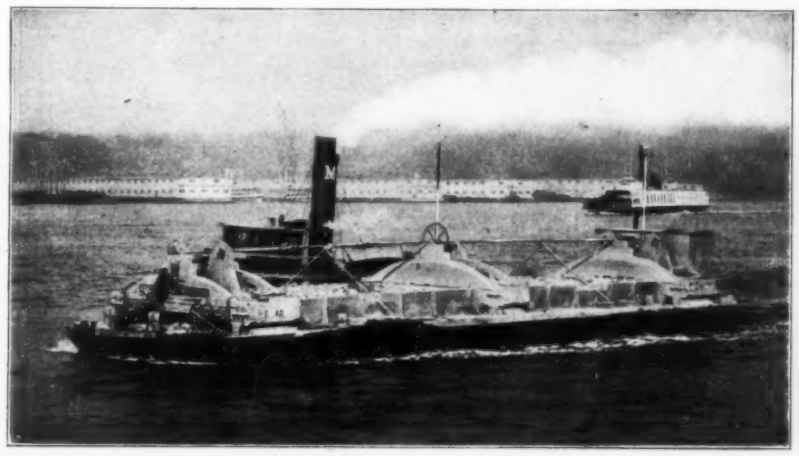


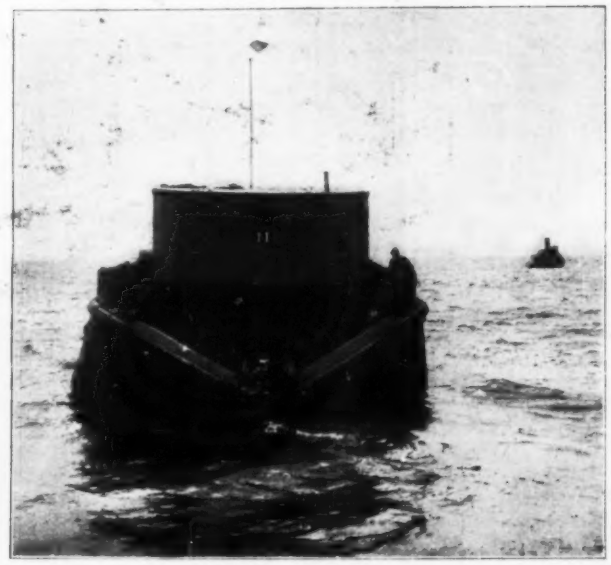
A DELEHANTY STEAM SCOW, SHOWING THE DOUBLE PONTOON.



TOWING A BARNEY DUMPER OUT TO SEA.

THE OLD WAY OF DUMPING GARBAGE AT SEA.

A former cause of the defilement of beaches in the vicinity of New York.



A BARNEY SCOW IN THE ACT OF DUMPING AT SEA.

The two hulls have separated to discharge the material.

THE DELEHANTY AUTOMATIC STEAM DUMPING-SCOW "ASCHENBROEDEL."

THE DISPOSAL OF CITY REFUSE.—[SEE PAGE 8.]

218536

AUTOMATIC CAB-SIGNALING.

A DISCUSSION OF MODERN RAILWAY SAFETY DEVICES.

BY J. PIGG.

Concluded from Supplement No. 1695, page 413.

TURNING now to the line equipment, the point represented as being approached is, as already stated, a three-way diverging junction. The six levers shown represent the "home" and "advance" signals for each of the diverging lines. Each "home" lever is fitted with a double-pole, and each "advance" lever with a single-pole switch, which are operated by the levers in the ordinary movement for operating the signals. The "home" and "advance" levers for the lines marked Nos. 1 and 2 connect the battery in the cabin with the bars, *B*, *C*, *D*, *E*, placed in the center of the track, the only difference being that the levers marked 1 apply the positive pole of the battery to these bars, and the levers marked 2 apply the negative pole to the same bars. The two levers, No. 3, connect the battery in the cabin to the supplementary bars, and if the junction were a four-way one, other levers would reverse the polarity precisely as is done by levers No. 2.

As will be seen, the battery is not applied to the bars unless both the "home" and the "advance" signal levers are pulled over. The mechanical interlocking prevents the levers for more than one line being pulled over at once, or the "home" signal for one line and the "advance" for another, and therefore in the case under consideration there is no need for more than one battery.

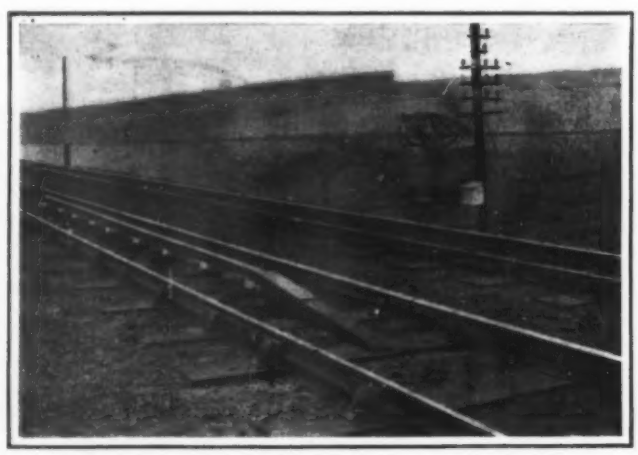


FIG. 16.—BAR B MOUNTED ON INSULATORS WITH RAMP FOR PROTECTION FROM SWINGING COUPLING CHAINS. BOX CONTAINING HIGH RESISTANCK FIXED TO TELEGRAPH POLE.

A view of the bar *A* is shown in Fig. 15. It is mounted on wood blocks, which are in turn mounted in stoneware reels. The insulation is not high, as there is no need to aim at a high degree of insulation for this bar. Fig. 16 shows the arrangement for mounting the bars *B*, *C*, *D*, *E*, and a side elevation and end section of these bars.

It is necessary that these bars should be well insulated, and they are therefore mounted upon double-shed porcelain insulators of the ordinary telegraph pattern.

A further consideration of Fig. 9 will show that the preparations made for signaling to trains are indicated in the signal cabin. The two indicators required in the case of a three-way or four-way diverging junction are shown in Fig. 9, and fuller views of the indicator are given by Fig. 17. When the levers are pulled over the current passes through a high resistance fixed at bar *B* (a box containing this resistance is shown fixed to a telegraph pole in Fig. 16), which limits the current passing before and after the engine reaches the signaling bars, but which, being in shunt with the engine circuits when signals are being given, does not affect the current to the comparatively low-resistance circuits of the engine. The resistance of the indicator is kept low with the same object. The permanent deflection is comparatively small. When the signals are being given the deflection is increased, and it can be used as an indicator to the signalman (1) of the position of the train which is approaching, and (2) whether the signals are being *given* on the engine.

Consider now in further detail what takes place in a typical instance. Assume that an engine is approaching the junction shown in Fig. 9, and that line No. 1 has been prepared for it to pass forward. The "home" and "advance" signal levers No. 1 are both in the "off" position, and the battery in the cabin is connected positive to line. All the bars *E*, *D*, *C*, and *B*, are connected to the battery. Bar *A* is never connected to the battery, and is in no way under the signalman's control.

When brushes 1 and 2 are on bar *A*, the current from the engine battery passes through c^2 d^2, c^1 d^1, A^1, C^1, brush 1, brush 2, and to the battery. At practically the same instant, the same circuit is separately established by each of the rotary switches 5 and 6. The semaphore arm is put to danger, and as soon as the brushes are clear of the bar, the bell commences to ring. Ordinarily the time occupied in passing over the bar is from 1/3 to 1 second, so that the bell practically begins to ring simultaneously with the raising of the semaphore arm.

The visual and audible indications given at bar *A* continue until the brushes, or brush 2, comes into contact with the bar *B*. A current then passes from the bar *B* to brush 2, thence to the coils of D^1, and the engine frame, and the rails, etc., to the battery in the cabin. The armature of a^1 D^1 is raised and breaks the circuit through the springs c^1 d^1, lowering the semaphore arm and causing the bell to stop ringing. At the same time the polarized needle *n* is deflected so that its pointer indicates 1, and the wire loop drops into the depression and locks the pointer in the position it has taken up (Fig. 18).

The visual and audible signal given at bar *A* is a "warning" signal indicating locally with reference to the signaling point being approached; the reversal of the "warning" signal is the "off" signal. If the further passage of the train on its journey to the "home" signal be followed, it will be found that the bell will ring momentarily at the instant the engine passes over each of the bars *C*, *D*, *E*, but no change is made in the character of the visual indication.

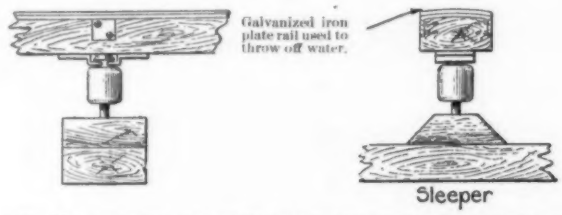


FIG. 16A.—DETAIL OF INSULATORS AND MOUNTING OF BAR B.

The indicator now shows the "off" signal by the semaphore arm, and route 1 by the pointer. These indications continue until the next signaling point is reached, and are a reminder of the last signal received.

Assume that the engine has reached another bar *A*. The same actions take place as described for the previous signaling point, but, in addition to raising the semaphore arm, the electromagnet *A*, by the rod *R* (Fig. 9), raises the wire loop out of its recess, and allows the pointer to assume its normal position. We assume again, also, that the road has been prepared for the train to pass forward, but, in this case, it is the right-hand road of a two-way diverging junction. On reaching the bar *B*, the same operations are carried out with the exception that No. 2 route is shown. It happens, however, say, that at the time the engine obtains the "off" signal, and "route" indication, 1,000 yards away from the cabin, the signalman is being informed of a circumstance which makes it imperative for him to stop the train if possible, and he instantly throws his "home" signal to danger, and immediately afterward the "advance." The engine at the moment is just reaching bar *C*, say, and on passing on to it, the "off" signal shown by the semaphore arm is reversed and danger shown, the "route" indicator is displaced, and the bell commences to ring as soon as the engine is completely over the bar. These indications will continue as long as may be necessary.

These actions constitute the receipt of a "warning" signal, the "off" and "route" indications and an "emergency" signal, calculated to avert a disaster from circumstances which have suddenly arisen.

Assume now that another bar *A*, belonging to another signaling point such as is shown by Fig. 1, has been reached. Precisely the same effects are produced there as have been already described. The line, however, has not been prepared for the passage of the train. On arriving at bar *B* the bell stops ringing momentarily, but the semaphore arm remains at danger. Immediately the brushes have left the bar the bell recommences. The same effects are produced at bars *C*, *D* and *E* if no other signal is obtained at either of those points. The last bar is placed close to the "home" signal and is double the length of the other bars to allow of the train being brought to a stand easily with the brushes on the bar.

Hence the "on" signal is obtained by the continuance of the "warning" signal after the engine has

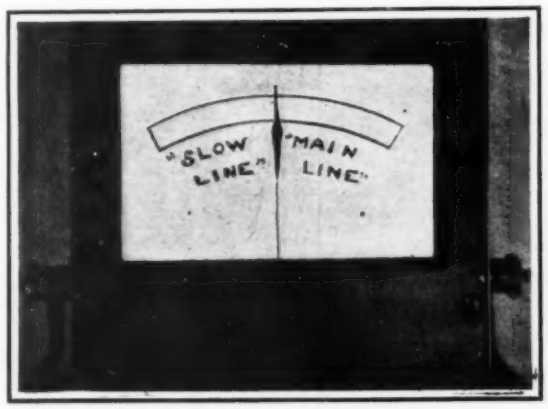


FIG. 17.—THE CABIN INDICATOR.

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* Abstracted from an address before the Newcastle Section of the Institution of Electrical Engineers.

passed over bar *B*, and that indication is continued until a subsequent indication is given by the signalman. The "on" signal, moreover, is of such a character, considered in view of the momentary stoppages of the bell by the intermediate bars, as to enable the driver to locate his position between the point at which he obtained the "warning" signal, and the "home" signal at which he must be prepared to stop.

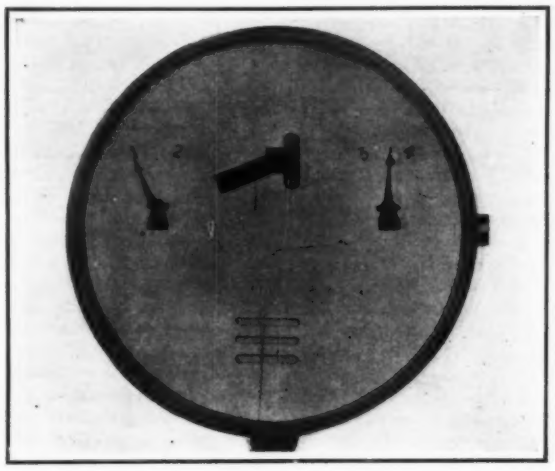

FIG. 18.—THE INDICATOR ON THE ENGINE.

The indication afforded under these circumstances is shown by Fig. 8.

Assume that as the engine approaches the bar *D*, the signalman lowers the "home" and "advance" signals. When the brushes come upon the bar the "off" signal and "route indication" 1 will be received precisely as already explained.

Hence the "on" signal originally received at *B* may be reversed, and an "off" signal may be obtained at points between *B* and the first "stop" signal just in the same way as the driver sees the line signal lowered before he reaches it in clear weather by the projection of his vision.

Making another assumption, suppose that the engine has been brought to a stand on bar *E* close to the "home" signal, and is waiting for the receipt of an "off" indication. The semaphore arm is at "danger," but the bell is silent. The signalman lowers the "home" and "advance" line signals for the train to proceed. Immediately the semaphore arm on the engine is lowered, the "route indication" 1 appears, and the bell commences to ring and continues to do so until the brushes have left the bar.

Hence, the receipt of the "off" signal when standing at the "home" line signal is given, and the driver's attention is called to the change by the bell commencing and continuing to ring.

Suppose, now, that instead of sending the train straight away after bringing it to a stand at the "home" signal, the signalman wishes merely to call the train forward to communicate with the driver, or to bring the train forward to the "advance" signal, the signalman lowers the "home" signal and works the "advance" signal lever back and forward.

The semaphore arm on the engine will be worked up and down and the bell will ring intermittently and call the driver's attention to the character of the indication given.

Hence a cautionary or "calling on" signal can be given to trains standing at the "home" signal, and the indication is of a different character to other signals obtained in that position.

In the foregoing description the signals have been given for a two-way diverging junction, or for a straight road. Suppose a train traveling to the signaling point in Fig. 9, and that road No. 3 has been prepared for it. The brushes 3 and 4 are connected together so that either is available for the same purpose. As shown by the diagram, brush 4 will engage with the bars parallel to *B*, *C*, *D* and *E*. The "warning" signal is given by brushes 1 and 2 on *A* as before. On the arrival of the engine at *B*, the brush 4 takes the current from the bar, after which it passes through the coils D^2, deflecting the needle n^1 to 3, and by the raising of the armature breaks the contacts c^3 d^2. The wire loop drops into the recess at the end of the slot in the sector, and locks the "route" indicator in the position required. The net result is precisely the same as described for the "route indications" 1 and 2 with the exception that the first of another pair of such indications is given. Had the junction been a four-way one, the action of the levers for the signals for the fourth line would reverse the polarity of the bars, and the indication 4 would be obtained. The next operation of the electromagnet *A* frees the "route indicators" 3-4 precisely as described for 1-2. The double brush, 3-4 is to enable signals to be obtained whether the engine is running engine or tender first, toward a three-way or four-way junction, and it is also used in connection with single line working to be described later.

The means for testing the condition of the circuits and battery on the engine have not yet been referred to. The actual indicator is a small disk (Figs. 7 and 8) or a grid (Fig. 6) appearing at an opening in the front of the instrument, which is white when the engine battery is in operation, and red if the battery fails or is cut off. The "failure indicator" circuit is independent of the other apparatus. Current is taken to the coils of E^1 from one end of the battery, and thence to the brush 2, which completes the circuit. Interposed in this circuit are two small electromagnets, the poles of which embrace the polarized needles n n^1, and tend to preserve their magnetism. As the "failure" indicator is always in action when the engine is in work, there is a constant current available for this purpose. In carrying the "failure indicator" to brush 2, the insulated wire is wrapped around all four brushes as shown in Figs. 9 and 10. Hence any obstruction on the line which displaces the brushes will break the "failure" indicator circuit and bring it into action. The "failure" indicator magnet E^1 has a back contact, e^1, which is open when E^1 is energized, but is closed if the armature, a^3, is released. This contact simply bridges the open springs, *c*, *d*, of A^1, and if the armature a^3 is released, through the breaking of the circuit E^1, the semaphore arm rises to danger, the bell commences to ring, and the disk or grid (Fig. 6)

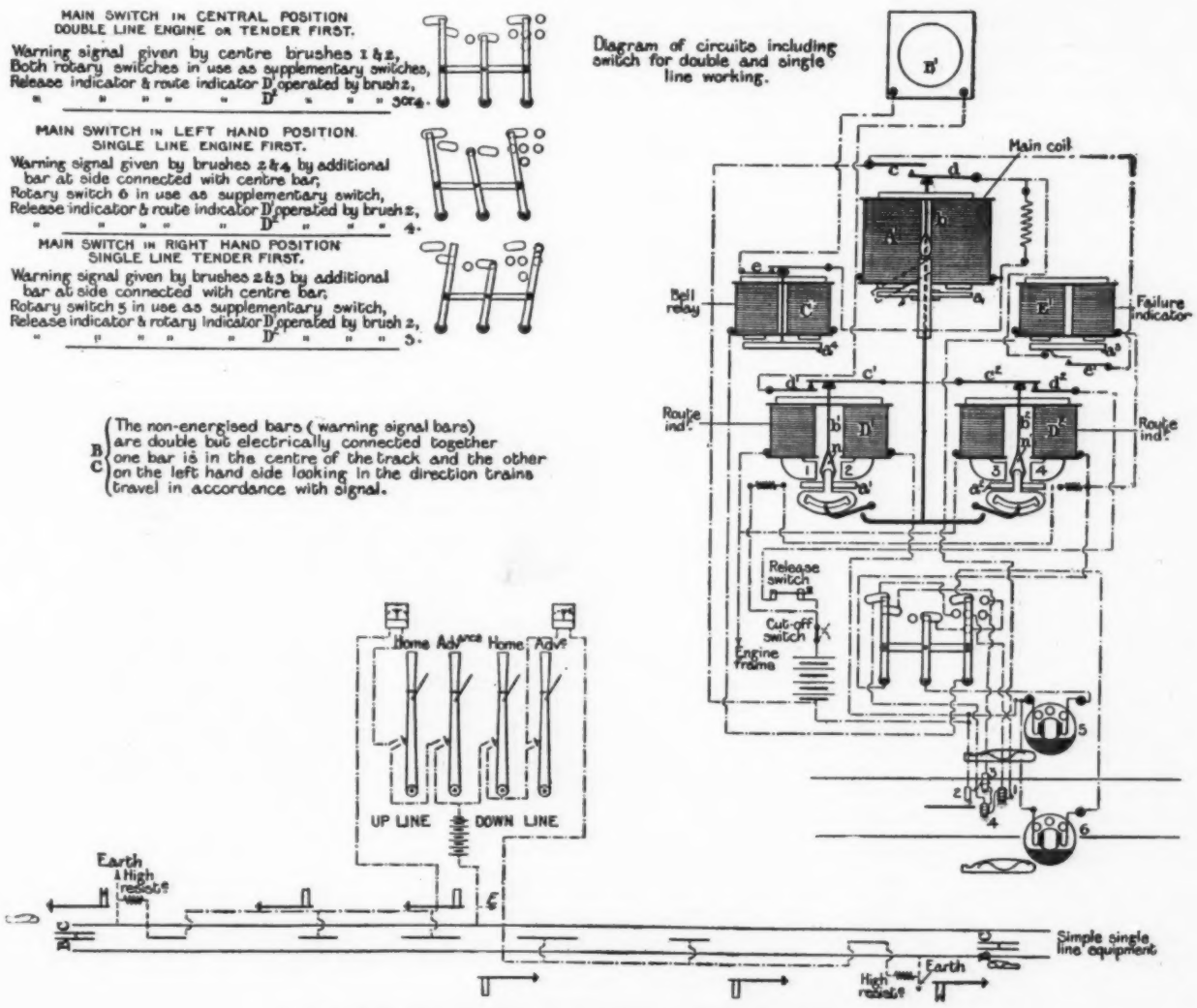
MAIN SWITCH IN CENTRAL POSITION
DOUBLE LINE ENGINE OR TENDER FIRST.
Warning signal given by centre brushes 1 & 2,
Both rotary switches in use as supplementary switches,
Release indicator & route indicator D¹ operated by brush 2,
" " " " " D² " " " 3 or 4.
MAIN SWITCH IN LEFT HAND POSITION.
SINGLE LINE ENGINE FIRST.
Warning signal given by brushes 2 & 4 by additional bar at side connected with centre bar;
Rotary switch 6 in use as supplementary switch,
Release indicator & route indicator D¹ operated by brush 2,
" " " " " D² " " " 4.
MAIN SWITCH IN RIGHT HAND POSITION
SINGLE LINE TENDER FIRST.
Warning signal given by brushes 2 & 3 by additional bar at side connected with centre bar;
Rotary switch 5 in use as supplementary switch,
Release indicator & rotary indicator D operated by brush 2,
" " " " " D² " " " 5.
B C The non-energised bars (warning signal bars) are double but electrically connected together one bar is in the centre of the track and the other on the left hand side looking in the direction trains travel in accordance with signal.
Diagram of circuits including switch for double and single line working.
B¹
Main coil
Bell relay
Failure indicator
Route ind.
Route ind.
Release switch
Cut-off switch
Engine frame
Home
Advance
Home
Advance
UP LINE
DOWN LINE
Earth
High resistance
Simple single line equipment
Earth
High resistance

FIG. 19.—ENGINE EQUIPMENT FOR SINGLE OR DOUBLE LINE WORKING.

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shows red. When the battery fails the disk or grid shows red.

Fig. 19 shows the engine equipment available for single or double line working. It only differs from Fig. 9 in the addition of a small 3-pole, 3-way switch. It is, perhaps, unnecessary to describe this in detail, as the side references afford sufficient information to follow the connections. In the center position of the switch the apparatus is ready for double line working, engine or tender first. In the left-hand position it is available for single line working, engine first; and in the right-hand position for single line working tender first.

The peculiarities of single line working require modifications of the track apparatus to obviate the receiving of signals on an engine proceeding in one direction, from the track apparatus provided for traffic proceeding in the opposite direction, on the same pair of rails. A simple single line equipment is shown in Figs. 9 and 19, an examination of which will show that the bars *A* are double, but connected together electrically, and that only one spring bar for operating the rotary switches is provided near *A*, instead of two as in double line working as described. The additional bar connected to *A* is always on the left-hand side of the latter looking in the direction in which traffic passes for which the line signals are provided. Similarly the spring bars for the rotary switches are always on the left-hand side.

An examination of the switch-circuits will also show that the operation of the switch to right or left always cuts out of use the right-hand rotary switch and the right-hand brush (3 or 4) looking in the direction in which the engine is traveling. It also puts out of action brush 1. Hence only the left-hand rotary switch and the left-hand brush (3 or 4 according to whether the engine is running engine first or tender first) are operative, and while the right-hand rotary will be turned by the spring bars for trains going in the other direction, the brush 1 will always bear upon the center bars, and the right-hand brush (3 or 4) will always bear on the right-hand bars, their usual functions are in abeyance in consequence of the position of the switch. The "warning" signal is given by the short-circuiting of the brushes 2-3 (or 4) and the rotation of the left-hand rotary. The "off" signals are taken up by the brush 2 for the "route indicators" 1-2, and by the brush 3 (or 4) from supplementary bars for the "route indicators" 3-4. All other operations remain as described. Hence a simple movement of the switch to one side or the other, according as the engine is running engine or tender first, is all that is necessary in passing from double to single lines, or *vice versa*.

The system lends itself readily to the adoption of means by which the "condition of line" signals obtained may be easily recorded for each signaling point. The length of time during which the semaphore arm is maintained at "danger" differs in accordance with the condition of the line. If an "off" signal is obtained at *B* the time is short; if the "on" signal is received the time will be longer, and will depend upon the point at which the "off" signal is ultimately received. In any case the difference is appreciable. This difference may be utilized in order to produce marks of corresponding length upon a cylinder which rotates and travels longitudinally at the same time, by adding a marking pen or pencil to the rod *b* of *A*', so that a mark is made as long as the armature (*a*) is raised. The motion of the cylinder causes the marks to form a spiral. For places where the "off" signal is obtained at the bar *B*, the mark is a dot only. Where the "on" signal is obtained at *B*, the mark is a line of greater or less length according to the time that elapses before the "off" signal is obtained. The drum carrying the paper cylinder is driven by clockwork, and is under the control of the signaling apparatus, so that it is only running when marks are to be made, and the driving mechanism and the marking cylinder are therefore kept of quite moderate dimensions. Arrangements are made by which the driver can produce a space longer than that provided by the design of the apparatus, and so distinguish between the marks made during one journey and the next.

CONCLUSION.

A careful consideration of the description will show how fully the apparatus meets the conditions found necessary or desirable in the introductory examination of the requirements.

I. (*a*) The natural action of the bar *A*, through the brushes, and that of the yielding bars upon the rotary switches upon the engine-circuits constitute a signal, warning the driver of his approach to a signaling point, at which further indications must be looked for *at once*. (*b*) Neither the engine driver nor the signalman are required to do anything to produce this signal. (c) The indications being given from three independent points for double lines, and from two for single lines, provide ample margins for failures of apparatus from any cause outside ordinary maintenance of the battery. (*d*) The alternative methods for producing this indication, and the difference in their positions on the engine and track, are guarantees that anything likely to affect one means prejudicially is not likely to affect the other.

II. The continuance of the "warning" signal constitutes an effective "danger" "condition of line" signal, relating to the "stop" signals which are being approached. The bar *A* is situated at a distance of about one hundred yards from *B*. The "warning" signal proper is therefore of short continuance only if the "stop" signals are "off." No time is lost in conveying the further indication "on" when the "stop" signals are in that position. The subsidiary indications, given by the momentary stoppages of the bell, are valuable for indicating the progress of the train toward the "stop" signal, when conditions of weather prevent the ordinary landmarks from being seen.

III. The stopping of the "warning" signal by the return of the semaphore arm to the "off" position, the stopping of the bell, and the receipt of the "route" indication constitute a complete "off" or "line clear" signal, which, since it cannot be given unless both the "stop" signals controlling entrance to the next section are "off," gives also the exact information now given by the lowering of the line distant signal. The convention under which the "route" indications are numbered is in strict accordance with the convention under which the line signals are erected. As will be seen from diagrams 1-5, the left-hand signals refer to the left-hand road, and so on, for any number of diverging roads. The numbering of the "route" indicators is from left to right, as will be seen by reference to Fig. 9. A straight through point is always signaled as 1.

IV. Either "condition of line" indication received at bar *B* can be reversed before the engine reaches the "stop" signal. That is to say, an emergency "danger" signal can be given at any one of several intermediate points if the "off" signal has been obtained; or an "off" signal can be received at the same intermediate points if the "on" signal was originally obtained at *B*. The number of intermediate points at which these reversals can be obtained is limited only by the number of intermediate bars provided. Additional bars are not costly, as will be obvious from the illustrations.

V. The "off" signal can be given when the train is standing at the "home" signal equally as well as when it is traveling, and attention is called to its being given by the audible signal. The signal given when the train is standing at the "home" signal can be modified by the signalman to indicate a "calling on" signal, or the equivalent of a flag signal, and this is totally distinct to the "off" or "line clear" signal referred to already in this section.

VI. Indications are provided in the cabin by which the signalman knows whether his apparatus is in order, and by which he can, if he desires, trace the progress of a train toward the "home" signal from the bar *B*, and note whether the signals appear to be given correctly.

VII. The system, being electrical, admits of the signaling point—the bar *B*—being put at any distance from the cabin without affecting the efficiency. There is, therefore, no reason why it should be put at the point at which the line distant is now erected. Such signals are usually visible at some distance, and there is no reason why the bar *B* should not be set at this "sighting" distance. The increasing speed of trains makes it desirable that the signals given at *B* should be obtained as early as possible, to admit of easy braking when necessary.

VIII. The line distant signal plays no part in the working of the system, and may be dispensed with if desired.

IX. A further examination of the system will show that failure of the apparatus on the line will not cause a false "off" signal to be given. Any failure of the battery in the cabin, or breakage of the line wire, puts the bars *B*, *C*, *D* and *E* into exactly the same condition as *A*, which can only produce the "danger" indications. Contact of the line wire with telegraph wires on the same poles is not likely to give a false signal, as the apparatus on the engine requires stronger currents than are met with in telegraphy. Failure of the apparatus on the engine provides its own indications. These have already been mentioned.

X. Probably the most important requirement from such a system is that of reliability. No matter what other advantages a system may possess, a want of reliability will be fatal. The most important point in any system is the means by which the signals are collected. Theoretically, the maintenance of such means of collection should be a matter of difficulty during bad weather, as snow or ice is liable to form an insulating layer upon the top of the line bars, and thus prevent the collection of the currents. As has been said, this is a theoretical consideration, and, necessarily, owing to the absence of bars for such purposes in this country to such an extent as to allow of the forming of a definite judgment, there is little or no local evidence for or against. The experimental work in connection with this system, however, has extended over the last two winters, and no difficulty has been experienced in collecting the currents from the presence of snow or ice. The surface of the bars is slightly rounded to allow water to run off; and only a thin film of ice can form. The contact between the brushes and the bars is of a particularly searching character, due to the construction of the former. They seem to clean the bars effectually at every operation, and if more engines were equipped, this question would hardly appear at all. In any case, occasional rubbing of the surfaces of the bars with an oiled rag, which can easily be done by the platelayers when making their daily inspection, seems to prevent the formation of continuous films of ice throughout the lengths of the bars. This matter is largely a question of adequate maintenance, obtained by co-operation with other departments. Like all engineering work, cab-signaling apparatus requires attention. Such attention is always better directed toward the prevention of failures than to repairs after failures have taken place. Intelligent maintenance is all that is required.

During the two years' experimental work, it has been found that the maintenance of the insulation of the energized bars, *B*, *C*, *D* and *E*, is of much greater importance than the contact between the bars and the brushes. The first energized bars were insulated in the same manner as the bar *A*, and worked perfectly well in good weather. Long-continued rain was, however, found to soak the sleepers and wood blocks supporting the bar to such an extent as practically to short-circuit the battery. Since the double-shed insulator has been adopted nearly eighteen months ago, no trouble in this respect has been experienced, and the insulators have given no trouble from breakage, except when they have been used as targets by mischievous boys.

The question of the reliability of the system is bound up in the maintenance of good insulation and perfect contact, since, although failure to collect the currents results in the maintenance of the "danger" indications, and is therefore on the side of safety, the "off" signal is of almost as much importance as the "on" signal, from the point of view of dispatch of traffic, and railway companies could not countenance any apparatus the working of which unduly delayed their traffic.

On the reliability of the systems depends the important question of whether railway companies will obtain any of the financial relief which, as already stated, is most desirable. The design of the apparatus is such as to render unnecessary the whole of the complex and dangerous arrangement of fog signaling by explosive detonators now universally used by railways at great expense.

XI. Further consideration will show that this system is capable of being adapted to use of parts, instead of the complete system as herein described, on less fully developed railways where the conditions of service are not so onerous. It is capable of being adapted to show signals for "distant" and "home" signals, or as already stated, it can be adapted to operate with the present "distant" signal only. As described, however, the arrangements are such as to give the maximum information with a minimum of apparatus, and, moreover, it provides further inducement in that, as the line distant signal is superfluous, it may be dispensed with. It is essentially a contact system in which shocks due to impact have been practically eliminated without impairing its reliability. As already stated, however, it is capable of being operated as a "contactless" system, with all operations for giving signals on the engine carried out under magnetic influence.

XII. The system has now been in use experimentally in the North-Eastern Railway for nearly two years, on what is the fastest short-distance train in the world, and on other express passenger trains. No attempt has been made to develop it by trials on slow trains. Under the conditions of use, the apparatus is working perfectly. The directors of the North-Eastern Railway Company have arranged for the equipment of twenty more of their express engines and of about fourteen miles of their main line between Newcastle and Durham.

Dry cells have been found to give the best results on the engine, and have given perfectly good results in connection with the track-circuits. Six cells are required on the engine, and twelve cells are used in the cabin for the track-circuits. The wire for connecting the energized bars with the battery in the cabin is carried on the telegraph poles, as seen in Fig. 16.

Pittsburg banks, several of which have been looted of almost $7,500,000 by dishonest employes in the last three years, have decided to adopt a Bertillon system by which a record of every person employed in the banks in Pittsburg will be kept. In addition to photographs and measurements, a record will be kept of each man's business career, his politics, his religious belief, whether he drinks or plays cards, and all other facts that the bankers think they ought to know about their employes. These records will be kept in one central place, where all the bankers who are interested in the movement can have access to them. The employes are indignant over the move.

MECHANICAL FLIGHT.

SLOWNESS AND NOT SPEED THE DESIDERATUM.

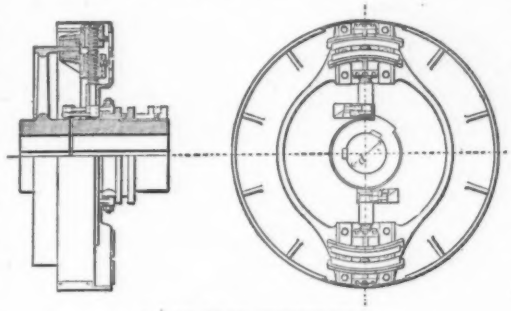
For many months mechanical flight has held universal attention. The popularity of the dirigible balloon has been displaced by the aeroplane, and the work of Santos Dumont and Spencer is forgotten in the exploits of the Wrights, Farman, and Delagrange. The conquest of the air is proclaimed by journalists, and columns of our daily papers are devoted to a subject which not a decade ago provoked ridicule and contumely. That is a kind of change to which the engineer and the scientist have always been accustomed; the "noble insanity" in them which "creates" what it cannot "find" is accounted real insanity by the thousands who are unable to comprehend the workings of their minds. But in these sudden changes there is always the same lack of balance, the same want of moderate and quiet thinking. From an extreme of disbelief a sudden spring is made into over-belief. The inventor finds himself a preacher at a revival; he effects something that the public deem a miracle, and straightway their want of any belief at all is changed into a belief in everything. They know neither moderation nor reason.

If anyone considers these observations too severe let him look at the papers for the last few weeks and then consider the results that have been actually achieved. Take first the winning of the Deutsch-Archdeacon prize by Henry Farman in Paris on January 13. Farman under atmospheric conditions which had to be watched, waited for and seized at the moment, sent word to the judges that he would attempt a flight. The judges assembled, a course was marked out, and the "aviator" started. He made the circuit laid down in the conditions and won the coveted prize. The flight was about one mile long, and he was in the air one and a half minutes! Attempting to repeat his experiment on a later day his machine was wrecked. He had conquered the air by a sucessful invasion—when the wind's back was turned—lasting one and a half minutes! What the two Wrights have actually done we do not know with any certainty. They have successfully sailed through the air with a self-propelling aeroplane, but how long the flight, how far, how fast we *do not know*. What we do know is that, like Farman's, their machine finished a journey by a descent of unpremeditated suddenness. Finally, we have the record-beating flight of Delagrange. At Rome, on Sunday week, he circled nine and three-quarter times—note the lack of completeness expressed in the three-quarters—round a rectangular inclosure. The distance he covered was 15 kilometers, and he was master of the element for 15½ minutes! The next day he essayed to repeat his success; the weather was not so favorable, and his machine also met with an accident. Taking all these official flights together, not one hour has been spent in the element that we are told has been conquered, and the minutes of success have only been snatched when the conditions put everything in the hands of the "conqueror." We have shown these facts in the least favorable light to enforce the truth that we have no more right to say these men can fly than the beginner who makes a sudden dash and covers a few yards before he falls off has a right to say he can walk the tight-rope. But we need not tell engineers that we are very far indeed from under-valuing the successes, short and fitful as they are, that have been achieved. A flight of ten minutes in an aeroplane is worth days of doubtful soarings in navigable balloons, and we give very hearty praise and congratulations to the men who have made the flights. But we must remember that the aeroplane is, and from its nature must remain, a very imperfect vehicle for flight. If we turn again to our daily papers we shall find that the admiration of the reporter increases with the speed of the aeroplane. Here is a strange perversion of judgment sprung from the motor car and the railway train! The thing to praise in an aeroplane should be slowness. As its speed increases all its other qualities increase in manifold. Its sustaining power and its stability depend upon its velocity; reduce that and it comes tumbling to the earth. It is like a cyclist on a tight rope without a pole or a parasol. Let him stop his machine and he falls into mid air. We do not hesitate to say the day will be seen when the biggest prize will be offered to the aviator who takes the longest time in going around the course—the race shall be to the slowest. That is the object which the inventor must keep in view, the object for which he must work. The problem of flight will not be solved so long as a high forward velocity is the only means of maintaining position in the air. Until we can go slow or fast at pleasure, flying will remain nothing more nor less than a sport with a very limited utility for military purposes. It will be impracticable to start or stop with ease, and impossible to maneuver with the exactness that is required in a "useful" vehicle. Can we imagine the condition of naval architecture if ships were built only on skimming dish lines and sank to the bottom if their speed dropped below 30 knots? The position is precisely the parallel of the aeroplane.

That the aeroplane will sustain weight has been known for very many years; that by carefully proportioning and planning it may be made to bear a man through the air has been proved by hundreds of experimenters; that it may be made self-propulsive and self-supporting has now been demonstrated. Aeroplane after aeroplane may now be repeated almost as readily as balloon after balloon. But we shall get little if any further by such repetition. The aeroplane is full of disabilities, and the search for other means of achieving flight must not be neglected.—The Engineer.

NEW FORM OF GRIP-JAW CLUTCH COUPLING.

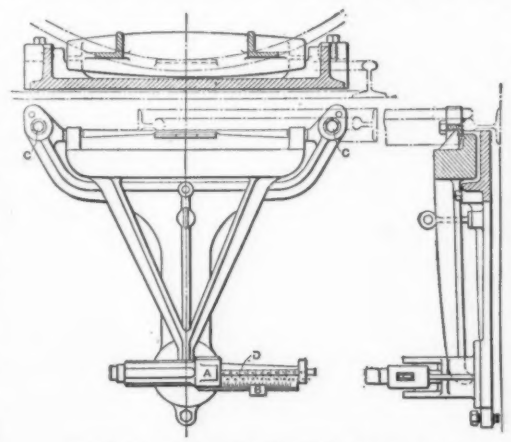
A new form of clutch coupling based on the old principle of jaws, actuated by a right and left-hand screw, gripping the rim of a pulley, is being manufactured in Germany. The cut herewith shows the construction and action of this device. A sleeve, traveling back and forth on the hub of the pulley which is keyed to the shaft, and actuated by a shifting lever, not shown in the cut, turns by means of a lever and crank, the right and left-hand threaded screw, thereby causing the jaws to grip the loose pulley and drive it. The jaws are made of wood, and fastened by wood-screws to cast iron brackets in the driving pulley. The dotted lines at the end of the hub of this pulley indicate the position of the operating sleeve when the jaws release the loose pulley, and the sectional view of the sleeve indicates its position when the jaws are brought in contact with, and drive, the loose pulley. The cut shows a pulley with only two pairs of jaws, but larger sizes are made with four pairs of jaws also, to provide for greater efficiency.—Machinery.



GRIP-JAW COUPLING.

LOCOMOTIVE WEIGHING MACHINE.

The machine illustrated in the accompanying cut has been designed for the purpose of determining accurately, and with little trouble, the load on any wheel of a locomotive without necessitating the use of a costly locomotive weighing table. The device illustrated consists essentially of a cast steel bracket, with a lever which transfers the weight of the wheel to a balance beam. The bracket is of Y-shape, the extremities of its two arms resting upon the rail, one at each side of the wheel. The lever is fitted with three knife edges, one pair of which bear on finished surfaces of the bracket and act as a fulcrum, while the other knife edge is located centrally beneath the wheel. By screwing down the set screws *C* in the arms of the bracket, the lever is raised until the weight of the wheel is taken by the central knife-edge. The scale beam *D* is connected with the weighing lever by a system of compound levers, the same as in an ordinary scale, and the two weights *A* and *B* are each, respectively, the sliding poises for the two scales for the weight in tons and hundredweights.—Engineering.



DEVICE FOR WEIGHING LOAD ON LOCOMOTIVE WHEELS.

PISTON SPEED AND STEAM ENGINE ECONOMY.*

By Prof. R. L. Weighton, M.A.

Some time ago a series of revolution trials were carried out on the experimental engines in the engineering laboratory at Armstrong College, Newcastle-on-Tyne. In general terms, the primary object was to ascertain by careful experiment the exact effect upon the steam consumption per brake horse-power of running engines of ordinary design and proportions—such, for instance, as are usual in marine practice—at varying speeds of revolution, ranging from the lowest up to the highest practicable, nothing being altered throughout the series except the resistance against which the engines were working. A second object was to discover, if possible, the maximum permissible speeds of steam and exhaust in such engines, with due regard to economy. This last with a view to the determination of the minimum sectional dimensions of the steam and exhaust ports, openings and passages, for adoption in proposed engines of this type, without entailing sacrifice of economy in working.

Two separate sets of trials were carried out, one with the engines arranged as quadruple, and the other as triple expansion, otherwise the conditions were as nearly as practicable identical for both sets, as follows:

Quadruples: Cylinders 7, 10½, 15½, and 23 inches in diameter; 18-inch stroke.

Triples: Cylinders, 10½, 15½, and 23 inches in diameter; 18-inch stroke.

Steam pressure in high-pressure chest, 138 pounds per square inch, absolute vacuum in condenser (barometer 30 inches), 24½ inches of mercury. Jacket steam shut off and jacket drains open. Receivers continuously drained by hand into hot well. Amount of lubrication of steam and of bearings, the same on both trials. Steam cut off in quadruples at 12½ inches, 10½ inches, 10½ inches, and 10½ inches, respectively; steam cut off in triples at 6 inches, 10½ inches and 10½ inches, respectively. Engines in both cases linked up very slightly, and to exactly the same amount in every trial.

Conclusions.—The results of the trials may be summarized as follows:

(1) For every reciprocating steam engine, when change in power is brought about by change in piston speed, there is a certain limit of piston speed at which maximum power is attained, and beyond which the power will fall as the speed is increased. There is also a certain limit of piston speed with which is associated maximum economy of steam used per horse-power developed.

(2) For the engines and conditions of the trials, maximum economy in steam used per brake horse-power occurred for quadruples at a piston speed of 441 feet per minute, and for triples at a piston speed of 474 feet per minute, the corresponding mechanical efficiencies being for quadruples 0.856 and for triples 0.87.

(3) The maximum-economy piston speed depends on several factors, the exact influence of each of which remains to be ascertained, but to a very large extent it is determined by the mechanical efficiency of the engines. An increase in the value of mechanical efficiency will, other things being unaltered, not only raise the economy absolutely, but will advance the maximum-economy point on the scale of piston speed.

(4) Both maximum-power and maximum-economy piston speeds are for the brake power considerably lower than for the indicated power, and therefore if the indicated horse-power were alone considered, the piston speed of maximum economy would appear to be considerably higher than it is in reality.

A New York ironmaster, who desires to reside near his foundry, has retained the services of an architect to fit up a suite of seven luxuriously appointed rooms, which will be so thoroughly soundproof that the noises from the adjacent foundry will not become a nuisance. In warm weather the heat from the foundry is insufferable, so special devices have been installed for cooling the suite of apartments.

* Abstracted from a paper read before the Northeast Coast Institution of Engineers and Shipbuilders.

CITY REFUSE AND ITS DISPOSAL.*

A DIFFICULT METROPOLITAN PROBLEM.

BY H. DE B. PARSONS.

CITY-WASTE materials may be divided into three parts: sewage; city refuse; and trade refuse. These may be further subdivided as in Table I.

The total refuse, excluding snow and dead animals, collected in the year 1906 by city and permit carts from the five boroughs of Greater New York amounted to 3,159,182 tons. The average quantities of refuse collected yearly per capita in Greater New York are given in Table II.

The average weights of the different classes of refuse, as collected in the Boroughs of Manhattan and the Bronx, city of New York, are: Garbage, 1,110 pounds per cubic yard; ashes, 1,086 pounds per cubic yard; rubbish, 143 pounds per cubic yard; street-sweepings, 1,016 pounds per cubic yard. The weights per cubic yard of these materials as collected in other boroughs vary to some extent. The greatest difference is noted in the unit weight of street-sweepings, which from macadam roads are heavier than those from asphalt or stone block pavements.

A TYPICAL NEW YORK DUMPING BOARD.

Barney dumper under outer board is receiving ashes; scow under nearer board is receiving garbage.

ONE OF THE NEW STEEL COLLECTING WAGONS.

A vehicle for the sanitary carrying of refuse.

TABLE I.

Classification of City Wastes.

Sewage	Liquid and Semi-liquid Refuse		House sewage. Street, roof and area drainage. Night soil.
City Refuse	Household Refuse	Garbage	Animal matter. Vegetable matter. Meat and bones. Fruit.
		Ashes	Steam ashes. Household ashes.
		Rubbish	Paper. Wood. Rags and bedding. Leather and rubber. Metals. Bottles, glass and crockery. Sweepings from buildings.
	Street Refuse	Street sweepings	Animal manure. Pavement dirt. Droppings from carts. Materials from building construction. Rubbish and leaves.
		Dead animals	
		Snow	
Trade Refuse			Cellar excavations. Materials from building construction. Stable manure. Market offal. Slaughter-house offal. Dead animals.

TABLE II.

Average Yearly Collection of Refuse Per Capita.

	Pounds.	Yards.	Percentages. By Weight.	Percentages. By Volume.
Garbage	181	0.163	12.31	8.45
Ashes	996	0.892	68.68	44.64
Rubbish	98	0.650	6.75	33.65
Street sweepings	260	0.256	17.68	13.26
Total refuse,	1470	1.931	100.00	100.00

Methods of disposal.—There are six generally recognized ways for disposal of refuse, some of which are limited to one or more of the subdivisions of Table I. These are:

Methods.	Application to
1. Dumping on land.	All subdivisions.
2 Dumping into water.	All subdivisions.
3. Plowing into soil.	Garbage and street-sweepings.
4 Feeding to swine.	Garbage.
5. Reduction process.	Garbage.
6. Incineration.	All subdivisions (except steam ashes).

1. *Dumping on land.*—Where primary separation is in force, ashes, with or without street-sweepings, can be used to reclaim land where a combined collection would be decidedly objectionable. In such case, the garbage, rubbish, and sweepings have to be dealt with separately.

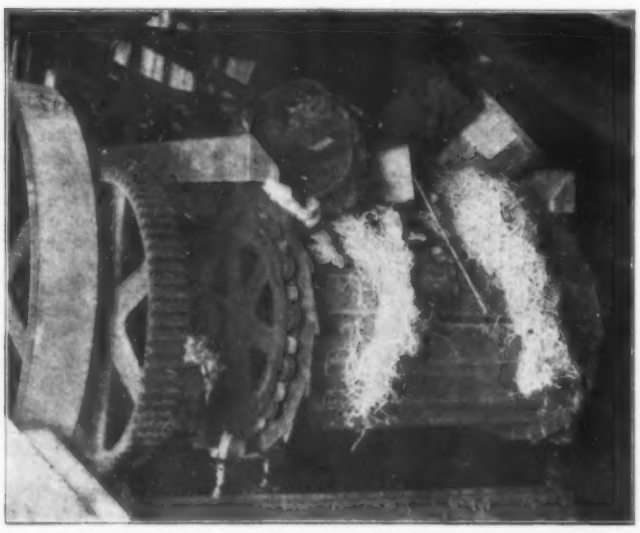
2. *Dumping into water.*—All classes of refuse could be dumped into water provided that the water is large enough in volume to dilute and scatter those portions which float, and deep enough to permit the heavier portions to sink without interfering with channels or navigation. Unless there be an almost uniform current away from the neighboring shores, this method cannot be recommended, and, where in use, efforts are made to abandon it in favor of some other.

3. *Plowing into soil.*—This method is only applicable to garbage, and possibly to street-sweepings. The soil should be sandy and the farm area large. The hauls will be necessarily long, and it requires the primary separation system for collection. It is inapplicable to cold climates where the ground freezes.

4. *Feeding to swine.*—This is a method applicable only to fresh garbage, unmixed with other refuse. It is seldom considered for large cities.

5. *Reduction.*—These processes consist of some method of "rendering" the garbage, by which the oil and grease are extracted, leaving a residue called "tankage." It is only applicable to garbage practically freed from rubbish, and can only be adopted by large cities, for, unless there be sufficient garbage, the first cost is prohibitive. Furthermore, it is only profitable when the garbage is rich in grease, which is one reason why it has not been more generally adopted by the southern cities of the United States. The best known systems are the Arnold, using live steam for melting and cooking; the Merz and the Simonin, using a solvent like naphtha and benzine.

The oil and grease are sold at a price varying from 2 to 4½ cents per pound. The crude oil is refined by the purchasers and used for commercial purposes. Its chief constituents are glycerine, stearine, and red oil.



RUBBISH DISCHARGED BY CONVEYER BELT INTO FURNACE HOPPER.

RUBBISH ON THE TRAVELING CONVEYER BELT.

The pickers sort out over half the material and sell it; the rest is conveyed to the furnaces.

THE DISPOSAL OF CITY REFUSE.

* Journal of the Society of Chemical Industry.

The tankage, when dried and ground, is odorless and dark brown in color. It is sold as a base for the manufacture of commercial fertilizers, and the principal market is in the Southern States. The price is based on the "units" of ammonia which it contains and its freedom from grease, and is variable. The tailings, or discarded tankage, are generally burned in the plant for fuel.

An approximate average working analysis of a reduction works is:

	Per Cent by Weight.
Water and factory losses	85
Grease (and oil)	3
Tankage	9
Tailings	3
Total	100

The first cost of a reduction plant is large, on account of the expensive machinery required; and the cost of operation and maintenance is high, because of the labor, fuel, wear and tear on the machinery and the corrosive action of the acetic and other acids produced during certain stages of the process. In general, reduction plants are not self-supporting, even if the garbage is delivered free at the works. In Cleveland, Ohio, a reduction plant is used by the municipality, and it is the only plant for which the financial details are available. The works are about self-supporting when the garbage is delivered to the plant without charge and when grease can be sold for at least 4 cents per pound. In cities where such works are successfully worked by contract, a bonus is paid for the reduction.

The advantages of reduction are:

1. The organic or putrescible matter of the garbage is converted into grease and tankage, which are harmless. Therefore, the garbage can be cared for in a sanitary manner.

2. It saves components which have a commercial value.

3. With a properly designed and carefully worked plant, the process need not be a nuisance, and its adoption adds a manufacturing industry to the city.

The disadvantages are:

1. Expensive machinery and apparatus with large costs for renewals and repairs.

2. The offensive odors that are apt to be given off require expense to prevent an annoyance.

3. As the works have to be situated at some distance from the city, haulage is an important factor.

4. Requiring skilled labor, there is some danger of strikes.

5. The garbage must be separately collected. There will always be some foreign material, tin cans and the like, which requires sorting out at the works.

6. There is usually but one plant, as a number of small plants would not pay. The whole system, therefore, would be crippled by fire or by any other cause that would stop the plant.

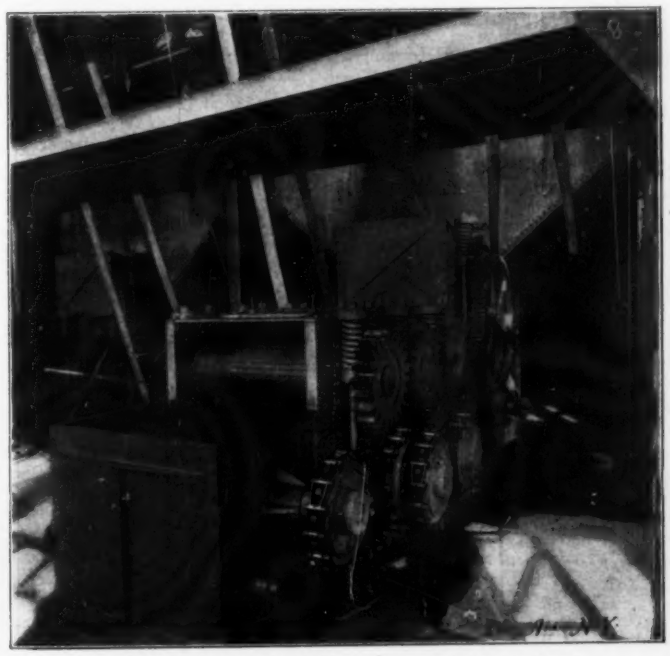
7. The process provides for the garbage only, leaving the remaining refuse to be treated otherwise.

Incineration.—Garbage cannot be incinerated alone unless previously dried or unless a fuel is used. It requires about one pound of average coal (10,000 B.T.U.) to incinerate eight pounds of raw New York garbage. There is no advantage in incinerating ash collections alone, as the expense would probably exceed the gain. It may be practicable at some future time to separate the coal and cinders, and such a process has been proposed, but not tried on a sufficiently large scale to warrant any predictions as to success. Rubbish burns readily and produces great heat. Some difficulties have been experienced by the production of slag. Street-sweepings from the better paved and centrally located streets will burn, as ordinarily collected, without the addition of other fuel, particularly as they contain a large amount of rubbish. When different classes of refuse are mixed, the aggregate is self-combustible, the coal and cinder in the ashes and the rubbish supplying the fuel required to dry the garbage and street-sweepings.

Sanitary incineration requires a high temperature not only to destroy offensive matter, but to make the escaping gases innocuous. The average temperature in the combustion chamber should be at least 1,500 deg. F.

The residue from incineration of mixed refuse amounts on an average to about 33 per cent by weight, or 60 per cent by volume. The volume at the destructor is large on account of the spaces between the clinkers, but when placed in a dump the volume is less, as the fine ash and dust work into the spaces. The heat may be utilized for power, and the clinker and ashes for brick-making, concrete-mixing, and for filling. It would be possible to press crude garbage and drain off some 15 per cent of the water beforehand, but this would add complications and might not pay in some places. On the other hand, it might render incineration possible in places where the other classes

AUTOMATIC CONVEYER FOR UNLOADING GARBAGE. (BALTIMORE PLANT.)



DETAILS OF THE PRESS OF THE BALTIMORE PLANT.

THE VALVE GALLERY IN THE DIGESTER DEPARTMENT OF THE BALTIMORE PLANT.

UPPER PORTION OF THE DIGESTER DEPARTMENT, SHOWING THE TOPS OF THE DIGESTERS AND FEED PIPES. (BALTIMORE PLANT.)

THE DISPOSAL OF CITY REFUSE.

of refuse are not fully collected or not found in quantity. In order to obtain high temperatures in the furnace, artificial draft should be used. One of the advantages of the plenum system for artificial draft over any form of induced or vacuum draft is the preventing of an inrush of cold air to chill the furnace when the doors are opened for firing, and the use of loose-fitting fire doors, which are more easy to operate than tight-fitting doors required for the induced systems. The draft pressure varies from ½ inch to 3 inches of water pressure, but should not be too great, as holes are apt to be burned in the fuel-bed and the stoking requires too constant attention. Probably a 1 to 1½ inch pressure is sufficient, but the best pressure should be determined by experience for each locality. The air supply in the blast should be about 46 cubic feet, or 3½ pounds per pound of average mixed refuse. Many furnace designers prefer a steam jet to an air blast, and both systems have their advantages.

In America the failures have been chiefly due to incorrect designs of furnaces, large grates, slow combustion, low temperatures, too much reliance on stoking, and inexperienced firemen. Unless high temperatures are generated in the furnace cell, the garbage mass will be subjected to frying rather than to cremation, and odors are sure to be discharged from the stack. The furnace should be designed only after careful study of successful plants. Owing to the high temperatures maintained, the fire-brick work should be laid up with freedom for expansion. The fire-bricks, according to the experience of George Watson,* should be laid with very close joints, and consist of from 60 to 70 per cent of silica, with 30 to 40 per cent of alumina. While a little iron is harmless, potash and soda tend to act as a flux, and should be present only in small quantities.

The advantages of incineration are:

1. When properly worked, it destroys all organic matter and offensive gases and reduces to ash all garbage, ashes, rubbish and street-sweepings.

2. The collections of ashes, rubbish and street-sweepings furnish the fuel. Garbage will also burn after drying.

3. Some revenue can be obtained from the heat generated through its conversion into power.

4. The system is sanitary, as fire is a sure destroyer of all germ life.

5. The hauls can be short, as a number of incinerators can be built and worked to advantage.

6. Civic authorities can work these plants better than reduction works, as they are more simple and less commercial.

7. No necessity for separate collections.

8. As a number of plants can be built, the risk of interference by fire or other causes of stoppage is reduced.

The disadvantages are:

1. The necessity of having expert firemen, and of exercising great care to make the incineration satisfactory.

2. When not properly designed or worked, incineration plants emit objectionable odors and dust.

Fuel values.—Table III gives approximate calorific values for the different classes of refuse, as collected in New York, and may be taken as representative of a large American city in the Northern States.

TABLE III.

Approximate Calorific Values of Refuse in B.T.U. per Pound.

	Dry Material.	Material as Collected Including Water.
Garbage	8,700	1,800
Ashes	3,000	1,800
Rubbish	7,500	6,500
Street Sweepings	7,000	3,000

In a mixed collection, these classes are found in about the following proportion, so that the combined calorific value would be approximately determined by the following calculation:

	Percentage Collected by Weight.	Calorific Value, B. T. U.
Garbage	12.3	221
Ashes	63.7	1646
Rubbish	6.3	409
Street Sweepings	17.7	637
Total	100.0	2913

This calorific value is about one-quarter of that of coal. If a ton of coal is worth, say, $3, then the mixed refuse would be worth about $0.75 per ton, less the additional cost of the handling of the refuse. One cubic yard of mixed refuse weighs about 960 pounds and of coal about 1,300 pounds, that is, the bulk of the refuse is about one-third more than that of coal for equal weights. In the same way the efficiency of the furnace for burning refuse is less than that for coal, when considered as a heat generator. Rubbish collections in New York have been burned on a large scale and accurate data obtained. (See Transactions American Society of Civil Engineers, 57, 1906.) Trials were made in December, 1905, to determine the rate of evaporation of water per pound of rubbish burned, and the results were an equivalent from and at 212 deg. F. of 1.64 pounds and 2.16 pounds. Subsequently, other trials were made by different observers, which gave equivalent water evaporations of 2.28 pounds, 2.29 pounds, and 2.17 pounds, respectively, per pound of rubbish.

The Borough of Westmount, Canada, has a mixed refuse destructor plant, which is worked in connection with the municipal electric lighting station. The average result, extending over a period of eight months, was that 2,000 pounds of refuse were equivalent to 283 pounds of coal. An evaporation trial, made in May, 1906, gave an average equivalent evaporation of 1.36 pounds of water per pound of refuse. The equivalent evaporation reported by J. T. Fetherston for eighteen European destructor plants, were, maximum 2.66 pounds, minimum 0.88 pound, and average 1.62 pounds of water per pound of refuse. These are gross evaporations, and in order to obtain the net useful steam produced for power purposes it is necessary to deduct that used for the forced draft apparatus.

Disposal.—The costs of incineration are not easily obtainable, because the figures are not always reported, and when reported are not on the same basis and are, therefore, not comparable. Furthermore, there are very few high temperature incinerating plants in America. The heat generated is unquestionably a valuable asset, but it should always be treated as a by-product. The object of an incinerating plant should be primarily to destroy the combustible portion of the refuse, and to reduce the several kinds to ash, thus leaving but one grade of material to be handled for final disposition, which is suitable for land filling and other purposes.

Closely associated with economy is the question of haulage. If the collection carts have long hauls to the central receiving stations, it means the maintenance of a large staff of men, horses and carts. The hauls, therefore, should be as short as possible, which can be secured by dividing the municipality into districts and placing in each district a receiving station. The ideal system would treat the material in these receiving stations, simply leaving the removal of the residue to the place for final disposition.

Garbage could not be treated by the reduction process in this way, as the reduction plants are not economical in small units, and are liable to be offensive. Where the reduction process is adopted, a system of primary separation allows the garbage alone to have the long haul to the reduction works, while other refuse could be delivered to the central stations and have the benefit of the short haul.

In comparing methods on a basis of costs of maintenance and working, it is proper to include in the costs the disposal of all the city refuse. Some methods can treat one, two, or more of the subdivisions, while others can handle but one.

The following items of cost will be found of interest:

COST OF COLLECTION, CITY OF NEW YORK, 1906.
Garbage, Ashes, Rubbish and Street-sweepings.

	Manhattan and the Bronx.	Brooklyn.
Total cost	$1,744,300	$772,900
City cart loads	1,747,871	630,000
Cost per cart load	0 999	1.225

COST OF FINAL DISPOSITION, CITY OF NEW YORK, 1906.
Garbage, Ashes, Rubbish and Street-sweepings.

	Manhattan and the Bronx.	Brooklyn.
Total cost	$815,300	$468,800
Cart loads	2,313,286	738,056
Cost per cart load	0 352	0.635

MANHATTAN AND THE BRONX.

	Garbage.	Ashes, Rubbish and Street Sweepings.
Total cost	$218,300	$582,200
Cart loads	250,300	2,043,724
Cost per cart load	0.873	0.285

COST OF INCINERATION, MIXED REFUSE, WESTMOUNT, CANADA. INCLUDING OPERATION, REPAIRS, RENTS, AND TAXES, 1907.

	Sinking Fund and Depreciation.	
	Without.	With.
Incineration, one ton	$1.08	$1.34
Revenue from steam	.58	.58
Net cost of incineration	.50	.76

* George Watson, Trans. Amer. Soc. M.E., 25, 1904.

STUDYING THE CONDOR IN ITS NATIVE HAUNTS.*

By WILLIAM L. FINLEY.

IN October of 1895, a pair of California condors (*Gymnogyps californianus*) were seen about one of the canyons of a certain range of mountains in Southern California. A search was made for the home of these birds at the time, but it could not be found. Every year since then, the pair of big birds have been seen, and many times efforts made to find the nest, but each time the hunters returned unsuccessful. One year additional evidence was found in the bleached bones and scattered feathers lying in the bed of the canyon. This bird was in all probability the young of that year and was ruthlessly destroyed by the rifle of some wanton wanderer. In 1905 the pair of old condors and a young bird, hardly able to fly, were seen perched on the limbs of an old dead tree, and the place was marked as this seemed to be definite proof that the home was nearby. But even this apparently definite proof was far from revealing the condor's nest in the rocky crevices and cliffs of the mountain side.

On March 10, 1906, I set out with two companions to make further search for the nest, and after a long and arduous search discovered it, the mother bird having been frightened into revealing it by pistol shots.

We climbed to the rock above the nest and found it was a huge bowlder set well into the mountain. Against this was leaning a big stone slab about ten feet high. This left a space about two by six feet and open at each end. This cave was lined with leaves and fine rock and in the middle was one big egg. We thought it was not far from hatching by its glossy surface and the tenacity with which the mother stayed on her nest.

It seemed to be the sound of the pistol that the condor feared, for that alone had made her leave her home. Twice one of the boys had crossed above the nest, and we had been yelling back and forth, but she had paid no attention to that.

A few days later we returned to the spot with camera, to obtain if possible a photographic life history of a bird which will soon be extinct. A heavy sea-fog hung low over the country, but we had hopes that there was blue sky beyond. As we went on the fog did not clear, and the prospects were indeed gloomy. We finally stowed away part of our equipment in the brush and with one camera started off.

When we climbed over where we could look between the rocks and see into the cave, the old bird was on. I went closer and could see her bald head of orange color, and the great black bird still sat on the nest. I climbed up within four feet of her and whistled and yelled till she rose on her feet. She looked so big that I shrank back at the thought of her pitching in to defend her young, for when she rose, I glanced in and saw a youngster not larger than the egg. His head was bald like his mother's, but baldness did not signify age in this case, although his head was fleshy-pink in color. He was weak, for he could hardly kick, and he seemed to raise his head with difficulty as he cried out in a wheezing, hissing note. Beside him lay the end of the egg from which he had emerged not many hours before. He was not yet dry. He was not even well clothed, for behind his little wings, the flesh was bare and his belly was bare, while the rest of his coat was down of pure white.

At first the mother arose and her neck feathers ruffled up in anger. Then as her baby began to squirm, she put her head down and covered him partly with her bare neck. Then it was evident we could not scare her from her den. But we had to have a picture of this baby bird, the nestling of the largest bird that flies, and one that is so rare in the ornithological world. Crawling over closer where I could look through the crevice in the rock, I got down within three feet of the mother as she sat hovering her chick. I could almost touch the white on her shoulder and plainly see the blood-red eyes that watched me, and the edging of white on her wing feathers. But she sat still till I reached in with a short stick, when she drew back as if to strike, but I had the advantage of her, for I knew that in that narrow place the big bird was almost helpless. When she arose and stepped back, I gently rolled the chick over nearer to me and reached in and took him in my hand. The mother sat in sullen silence.

We immediately set up the camera in the pelting rain and focused it on a sheltered spot just outside the den of the old bird, then placing the chick on the ground, took a snap of him. Covering him quickly so as to keep him warm, we tried four more exposures in about the same position. But the darkness of the weather made a slow exposure necessary and the youngster wiggled most of the time. But by that time it suddenly dawned on us that he was getting chilled and I hastily put him back in the nest.

But to my chagrin, the old bird just sat with her head down and paid no attention to the chick under her nose, who had now grown too weak to even squirm.

* Copyright 1906 by W. L. Finley and H. T. Bohlman.

He seemed nothing more to her than the shell by her side. I knew the chick would die if he were not warmed immediately, so I climbed around to the front door of the cave and tried to make the mother move over and hover her nestling. This would not work, so I reached in and got the youngster again and he was chilled through, and with our cold hands we could give him little warmth. As a last remedy we held him close in to our warm bodies, and after a little while, he began to squirm again as the warmth seemed to revive him.

At that instant, I looked up and saw the male condor soaring above and dropping lower and lower. My heart sank for a moment as I felt like crouching down and crawling under cover. But reaching for my tripod as a weapon of defense, I stood there while the big bird swung around only a few yards above our heads and lit on the perch of the dead pine about forty feet away. He sat there with wings outstretched and watching us closely. It made us crouch closer behind the bushes to have a bird of such size so near above and threatening to pounce upon us at any moment. But we soon saw that he had no intention of fighting.

All the time we were in great doubt as to whether the mother would accept her chick again if he were revived. She sat there all the while with her head down watching through the crevice. As soon as the young bird revived so he could kick about, I crawled down near the nest and thrust my arm clear in till I almost touched her nose and put the chick down before her. Then I slid back down the rock. It was a moment of intense anxiety for me; if she did not take the chick to her, it meant his death as well as an end to all our dreams of getting a life series of pictures of this rare bird. For an instant she paid no attention to him, but just then he began to stir and wiggled. Her eyes changed from their vacant stare: she suddenly seemed to recognize her nestling, and putting her bill down she drew him gently near, crouching down at the same time and finally drawing him under her breast. We felt very much relieved at this and hurriedly taking our camera, we started back down the mountain leaving the pair of big birds and their nestling.

The rain had continued till everything was soaked. Wading through the brush, we were soon wet through and then after the climb up to the trail again, we had the worst part to traverse, for the path was through the high bushes, each of which held a shower of drops. But we had five plates any one of which, if it were good, would pay for a thirty-five mile trip into the mountains, and better still we had the hope of getting more in the future.

On April 11, 1906, we made another trip to the condor's cave. While ascending the steep slope to the nest, a large bowlder was accidentally loosened and narrowly missed taking the camera man along as it dropped into the canyon with a loud report. The next moment, the old condor, aroused from her nest, flapped to her perch in the dead tree directly over our heads. We watched and waited, hoping she would return to the nest. But after about fifteen minutes, she raised her wings, hooked her bill about the stump, parrot fashion, and climbed to a higher perch. We crawled on up behind a cover of rocks to get a picture. While fixing the camera, I looked up and the old male was just alighting beside his mate on the dead tree. We crouched down to watch. If the birds saw us, they paid no attention to our presence. The mother edged along the limb and put her head under his neck. Then she nosed him as if asking to be fed, but he responded rather coldly by moving away and she followed. This crowded him out where the limb was too small, and he jumped across back of her. He seemed to get more friendly and the two sat there side by side, nibbling and caressing each other.

We began crawling further up the ridge for a nearer picture. When we came in full sight of the birds, to my surprise they paid no attention to us. We stopped to take another picture and then climbed on up the steep rock with our cameras on our backs. Under cover of a small bush, I came to a point directly opposite the pair and only about forty feet away. Seeing the condors had no fear of me, I climbed straight out to the edge of the ledge and made some exposures while the mother sat preening her feathers. As neither bird seemed the least anxious as to our presence, I began to enjoy the sensation of getting so close to these big birds in their wild mountain haunt.

In a few minutes, the old male spread his wings and dropped off down the canyon. The next time I saw him, he was a mere speck, soaring high above the mountain. The mother kept turning her head and watching him all the while he was in the sky. Finally she too sailed off.

When we climbed around to the nest, we found the condor nestling had grown from the size of the egg, or from about a double handful, till he filled my hat. The down on his body had changed color from a pure white to a light gray. Instead of the flesh color on his head and neck, it had changed to a dull yellow. He sat with his shoulders humped and his head hung as if in the last stage of dejection. The minute he saw me, he began crying in a note most peculiar for a bird, for it sounded exactly like the hoarse tooting of a small tin horn. However, he only used this note a few times; then he began hissing. He showed his resentment by drawing in his breath and letting it escape as if through his nose. His feet were short and stubby, the feet of a scavenger. What a deterioration from the eagle! The claws were like those of a chicken rather than a bird of prey. The head, the bill and even the look in the eye were very different from the savage expression of the eagle even in babyhood.

When we picked the youngster up in our hands, he objected in a feeble way by trying to bite. Both the parents had left the vicinity, and we sat him down at the entrance of his home to get some pictures. One of the parents was soaring high in the air, and he seemed to see his chick, for he began to descend rapidly. It looked as if he had something in his talons, but when he came nearer, we could see his legs and feet were hanging down as birds often do when about to alight. He seemed to do this as an aid in dropping suddenly. He swept in near us and lit on the old dead pine and was soon followed by his mate. The old birds looked so serious as they sat there staring at us and their young, that we hesitated, for we were not in a position for trouble there on the steep side of the mountain. But they had no intention of stopping us in our work, for they seemed to take the whole enterprise from the point of view of curiosity.

There was something ominous about the condors and their nest cave. Never a sound came from the birds: they came and went like great black shadows. One minute you might see a mere speck in the clouds, and a few moments later this creature with a wing-spread of ten feet, would skim past only a few yards above your head. There was hardly a swish of the wings to tell of his presence.

April 25, the next trip we made to the home of the condor, the pair of old birds met us at the mouth of the canyon. One of the birds sailed out over the top of the mountain, quite high in the sky. In a moment the second bird followed lower down. They were perhaps out for a short morning fly after attending to affairs at home. The lower bird, likely the female, soon flew back up the canyon, while the other sailed straight out over the valley toward the east.

Four hours later, I edged down the steep rock as quietly as possible with my reflex camera in hand, and worked my way along to the nest. When I got where I could look through the crack into the cave, there sat the old condor mother sound asleep. She was brooding her nestling. I dropped back behind a bush and got my camera ready. It was too dark to catch her as she left, but I thought she might pause at the threshold and give me a chance for a picture. Then with my camera ready to snap, I gave a short whistle to arouse her. Then moving a little closer, I gave a louder whistle. In an instant she knew I was there, for she plunged headlong out from behind the rock, and lit scared and half dazed on her perch a short distance away.

When we stooped to look at the nestling in the cave, he jumped right out at us. He was in a savage mood. If his mother would not stay to defend him, he intended to fight for himself. I could see that he was developing good fighting qualities. His mother might have showed fight too, if she were cornered as he was.

The young condor was growing steadily, for he was now thirty-five days old and as large as a good-sized chicken. His whole body was covered with dark gray down with the outer edgings of lighter gray. When I put down my elbow, he lunged forward and struck it such a hard blow with his bill that it would have drawn blood had he hit my bare hand. The minute I appeared, his neck puffed out with wind and his whole crop filled till it felt just like a rubber ball. He seemed to use his crop as a supply tank for air, which he blew out slowly through his nose to express his anger.

He sat with his head down and mouth open. The front part of his tongue was round and it folded over from each side and met in a little crease down the front. About an inch back, it looked as if it were partly cut in two, for it was narrower and flatter. Such a breath as that youngster had! I could not describe it, and I tried to forget it as soon as possible.

That evening we watched the old condor to see if she would go back to the nest. But at six o'clock she settled down on her perch with her head drawn in, and went to sleep. The young condor had to sleep alone.

We awoke at daylight in the morning with a cold draft drawing down the canyon. The old condor was still sound asleep on the dead tree up the mountain cliff. At six-twenty, she sailed across over our heads and lit on the side of the cliff. She was there but a moment when she spread her wings and dropped back across to the nest where she stayed an hour, after which she took up her perch on the tree.

We examined both the old birds from a near point of view and found they were almost identical. We were not positive, but took it for granted that it was the mother that stayed at the nest. The other bird, likely the male, seemed to be a trifle larger. At this season as well as during the period of incubation, the female seemed to stay on the nest or nearby, while the male did all the hunting.

We had seen nothing of the male since the morning before about ten o'clock, when he disappeared high to the east. As the mother sat there on her perch, she often turned her head and scanned the heavens, looking for the coming of her mate. By watching her, our attention was first called to a mere speck in the sky. It grew with surprising rapidity, and as it took better form, we could see a bird coming toward us with extreme speed. Through the field glass, we could see that the feet were dropped, and we knew it was the male condor, for this was the way he always came. With one great slide to the west, and a long swerve to the north, he circled with the curve of the canyon and brought up on the top of the dead pine only thirty feet away. I never saw such a slide as that bird took. Such smoothness and grace! And such speed!

Each day at the nest we seemed to be getting on more intimate terms with the old birds. The minute we lifted the young condor from behind the rocks, the old birds were very much interested. They both came over to a nearer perch where they could see, and they twisted their necks to watch every move we made. When the mother saw her gray nestling, she flew across to the rocks above us. Then she ran along the steep slope, but had to help herself with her wings to keep her feet, and hopped up on a small oak limb just above the nest and only twenty feet distant. The old male followed and both sat watching us from the tree. It was all anxiety with them, and we were so anxious to get their pictures, that we could not shoot fast enough. In a short time, all our plates were gone and we had to sit down and watch, and wish for more.

This gave us the best chances to study both the old birds. Their bills were of dark horn color and the red skin of the head extended down covering the bill about half way. The feet were of similar color, but on each knee was a patch of red. There was a brighter patch of red on the breast of each bird, which could occasionally be seen when they were preening and when they spread their breast feathers. Both had light-colored wing bars and the primaries were well worn. The skin on the throat hung loose and the lower mandible fitted in close under the upper, giving the bird a peculiar expression. The chin was orange and below this on the neck was a strip of greenish-yellow merging into brighter orange on the sides and back of the neck. The top and front of the head were bright red, but between the eyes was a small patch of black feathers, and these extended down in front of the eye till they faded into the orange red of the neck. The pupil of the eye was black, but the iris was deep red and conspicuous. The top of the head was wrinkled as if with age. The ruff, or long shiny black feathers about the neck, was often ruffled up, giving the bird a savage appearance. Behind the ruff on the back the feathers were edged with dark brown.

When we made the next trip into the mountains, to our surprise a third condor appeared above the nest in the afternoon. He was a ragged looking bird, with two or three feathers out of his wings and one missing from his tail. We first noticed the new bird as we saw the parents watching him intently when he was high in the sky. He began circling nearer and nearer till he finally lit on the side of the mountain a few hundred yards up the canyon. The parents watched him closely for some time without a move, till the new arrival, thinking his presence was not objectionable, flew down and lit nearer the nest. The male set out after him and the third condor flew back up the canyon. There was some objection to the new comer, but it was not serious, for he stayed about all the afternoon, and at one time lit for a moment on the dead tree near the nest. The male drove him off, but only chased him a short distance.

The third condor seemed a trifle smaller than the other two, but he was almost as brightly colored as the parents. We were inclined to think he was one of the children of former years. We watched the three birds till six o'clock and then climbed down to make camp. The parents were perched on the dead tree in front of the nest, and the third bird on the mountain side above, and there they went to sleep for the night.

Early the next morning we found one of the birds, presumably the male, and the intruder gone, while the other still sat on the tree-perch. About noon the father appeared in the eastern sky. The mother saw him first and we were attracted by her watching. We were surprised again to see the third bird following a little in the rear, and he came on down and stayed during the afternoon. The crops of both birds were bulging out when they returned, showing that they knew where to get food.

The young condor was now fifty-four days old, but he was still clothed in gray down. It was over two months before the first black feathers began to show on his wings, and they developed very slowly; for by the first week in July when we had expected to complete our series, the young bird was not half feathered out, although he was three months and a half old and weighed over fifteen pounds.

We could see that the parents were becoming more

and more attached to the nestling, and they were becoming tamer and tamer while we were about. The nestling was wilder and more ferocious as he grew. The only way we could touch him was by wearing heavy gloves or by blindfolding him. He lunged about and fought while he was in the cave; but when we got him out of his home, he seemed to change tactics and to become quite meek. While we were getting pictures of him, the parents sat about only a few feet away. They were almost devoid of fear, for several times they stood within five or six feet of us in perfect unconcern. Of course, we had been extremely careful from the first not to scare them and not to make any quick movements while they were so near. In all our study of the home life of these birds, there was never the slightest indication of ferocity on the part of the parents. Their attitude was one of anxiety and solicitation.

The last afternoon when we took the young condor out of his cave and he appeared blindfolded, the mother jumped back as if scared, for she could hardly recognize him without a head. We placed him on a narrow ledge of rock, removed the blind and the mother edged down to her young. Then she began caressing him, pushing her head under his wing and biting him gently on the leg. I never saw a greater show of affection in any bird than the two condors seemed to have for each other and for their young. The longer we studied and the more we watched this family, the stronger our own attachment became for the birds.

While we were taking our final pictures of the condor family, two more condors appeared high above. With a field-glass, we recognized one as the former visitor, the ragged bird with missing feathers in the wing and tail. The two new arrivals sailed about in circles for a while and then we saw the ragged bird descending. The father of the young condor seemed to get more anxious and flapped across the canyon and back. On came the visitor till he was only a short distance above the top of the mountain. Then the father sailed rapidly down the canyon and around the bend out of sight. The third bird dropped lower and lower in circles while his mate stayed higher up in the sky. The father of the young bird was gone about five minutes, when he suddenly appeared right over the top of the mountain and higher than the visitor. He had made a feint and got the advantage of position. Drawing his wings partly in, he dove at the intruder who saw him coming and increased his speed down the canyon. Dodging the enraged condor, he circled back up a small side ravine and both disappeared behind the mountain. In a few minutes, they came into view again higher in the air and going toward the west, the old condor flapping wildly to strike a blow and the pursued one dodging back and forth to escape. They were undoubtedly two males, for the mother sat calmly looking at the chase, while the mate of the ragged bird sailed about watching the outcome. After another wait of several minutes, the two birds appeared again, but far up in the sky; the ragged bird was flying straight to the east, still dodging the mad condor at his tail. And on they went as far as I could see, with the mate of the ragged bird following some distance in the rear. In about half an hour, the father again appeared, sailing slowly back alone, victorious in the chase.

Photographs of the old birds and their young chick will be found in the current issue of the SCIENTIFIC AMERICAN.

FUNGI DESTROYING EASTERN FORESTS.*

THE DISEASES OF TREES.

BY WILLIAM HOSEA BALLOU.

PRACTICALLY all of the chestnut trees of the Eastern States are dead, destroyed by a small deadly parasitic fungus, *Diaporthe parasitica*, named by Dr. W. A. Murrill, assistant director of the New York Botanical Garden, and who is authority for the above statement. In Prospect Park, Brooklyn, 1,500 chestnut trees and in the Bronx parks several thousand chestnut trees have been cut out, roots, trunks, and branches, and burned. The government forestry service estimates that one-third of the pine trees of New England are dead from a leaf blight. Of my own observation I will say that the yellow pines and red cedars of the East are being destroyed principally by *Fomes annosus* and other fungi, and other trees as hereinafter stated.

The infinite forms and variety of over thirty thousand species of fungi are most impressive. There are thousands of forms of the "toadstool" or mushroom type. Of the longer-lived types, there are those which attack live trees only, some of which die when they have killed a tree and others which continue to live on it. When the tree is dead, it may be attacked by other forms which live one or more seasons and reproduce annually, although the dead fungi harden and may hang to the tree, shelf-like, for years. As the tree proceeds in its decay, new forms attack it until it rots to dust, the punk itself being a fungous disease. On the bracket fungi themselves, other parasites often live, such as lichens, mosses and other and smaller fungi. The lichen is a pseudo fungus or a pseudo moss, the evolutionary connection between the twain.

* Photographs by the author.

Some fungi, such as *Daedalea quercina*, attack dead spots on living oaks, dead oak stumps or logs. Some forms such as *Lenzites betulina*, attack all dead trees, logs, stumps, and roots indifferently. Each tree usually has its special species of fungus which, as a rule, attacks no other species of tree. Many fungi are edible and many are deadly poison. The woodland bracket fungi are mostly all beautiful to the eye. The summer toadstool forms are often disgusting, both to the sight and the nostrils, although many are beautiful. The brackets often emulate, for some kind of protection unknown, the coloring of the bark. The fungus of the white birch, *Piptoporus suberosus*, for instance, is covered with a white skin, colored and marked so like the birch bark as to be nearly indistinguishable from it, and appearing like a tight fitting, white kid glove. Nearly all of the white birches of Ocean County, N. J., are dead and covered with these brackets. Some forms are found in dark cellars such as *Fomes annosus* and *Schleroderma vulgare*, the former attacking the roots of coniferous trees and overturning them, and others, like *Lentinus lepidus*, attach themselves to railway ties and culvert abutments, sending root-like connections into the hot sand or cinders. I say "root-like" because botanists describe the fungi as "without true roots, leaves, or stems," notwithstanding the apperent roots (mycelium) which they sink into tree or soil to hold themselves in place. As a rule, the tree bracket fungi grow rather low, that is, within ten feet of the ground. However, there are many species growing at from 50 to 70 feet in height. These forms and others grow on trees in swamps or high and dry lands indifferently. The idea that a fungus is a growth always due to dampness is erroneous. The *Lenzites betulina*, for instance, may be found flourishing on a log under water in a swamp or on the faraway high-lands, where only rain, dews, fogs, or snows may dampen it. The fungi may be considered saprophytic and parasitic forms, as a rule, entirely independent of climate, atmospheric conditions, altitudes, or depths. The bracket forms follow trees and shrubs and destroy them if living or exist on them if dead. The toadstool types are equally at home on, above, or under ground. The fungi, however, are not to be found everywhere. There are often square miles with scarcely a trace of a fungus visible, clean woodlands in which parasite and saprophyte are unknown. Again, in a single square mile, one may discover fifty species of fungi. I have one square mile of forest in mind in which all the trees, except on the edge, have been killed by fungi, a fate that is sure to overtake the remainder, unless the owner, whom I cautioned, immediately cuts out the good, live, lumber yet standing.

"Great oaks from little acorns grow," the proverb tells us. Much poetry and prose has been expended upon the "sturdy" oak, yet of all trees, it is perhaps the one most attacked by the largest number of species of fungi and driven to its death by them. The most impressive parasites of the oaks and the most deadly are the twin brackets, *Pyropolyporus ignarius* and *P. Everhartii*. Until recently, the two species were confused, when they were separated by Dr. Murrill. I was fortunate enough to locate at Forked River, N. J., the most typical illustration of the latter species. On the

DAEDALEA CONFRAGOSA, WHICH DESTROYS CHERRY TREES, OAKS, ETC., ATTACKING DEAD SPOTS.

KLEVINGIA MEGALOMA GROWING ON A HICKORY TREE NEAR RED BANK, N. J.

PYROPOLYPORUS ROBINIÆ ON A LOCUST TREE NEAR NEW ROCHELLE, N. Y.

FUNGI DESTROYING EASTERN FORESTS.

edge of a large swamp was a huge oak stub which towered some 50 feet high. Commencing at the base, the big brackets stood out, curving in spiral form to the top, beautiful in death, darkened by weather on top, but with a lovely sheen of golden whitish on the bottom. Here apparently were the grandparents of the new Everhart species, as brackets bearing that name have never been found elsewhere of such size.

PLEUROTUS ULMARIUS IN FORKED RIVER VILLAGE, N. J.

From where I stood I counted nine big brackets, but when I got on the other side of the stub I saw three more. On the ground were the rotted remains of many more, one can never tell how many. The brackets diminished in size somewhat to the top of the stub. The number of layers of a bracket fungus show its age. As the top cracks and breaks by reason of attacks of weather, etc., it is not possible always to determine the exact age. On one of these brackets of the stub before me, are at least a dozen layers. It required then at least twelve years for these brackets to kill the giant oak and no one can know how many years the tree and its brackets have since been dead. Its top has completely disappeared, but may have been hauled out for firewood in winter, when the ground was frozen. The reason for the species being new may be found in Murrill's "Contributions."* He says: "The type of this fungus is in the Herbarium of the New York Botanical Garden. Since its discovery on the living trunk of a scarlet oak in New Jersey, it has been collected in several localities on various species of oak and occasionally on beech. Before its separation as a distinct species, it had been confused with *Pyropolyporus ignarius*, which it outwardly resembles in some particulars. Since locating the stub, I have found hundreds of specimens, both living on live trees and dead on the trees they had killed. Of *Ignarius* I have also found plenty of specimens, mostly from chestnut oaks.

Passing through a white cedar swamp one day where woodsmen had made a clearing, I came across a clump of fallen trees covering perhaps an acre of ground. The woodsmen proposed to save the lumber in the trees. They pointed out peculiar mats on the tops of the roots, above ground, consisting of black fibers very like the coarse hair of Indians, only coarser. I removed one of the most striking mats and noted that it was the cedar root hair fungus, *Agaricus melleus*. It is described as a pseudomorph, having a fungus-like root with black cortex. It bores into the roots of cedars, cutting them through, after which the wind topples the trees over. In warm weather it is followed by a rhizomorph, or root-like fungus, which sends up a "toadstool," good to eat. Does it try to overcome its evil by this attempt at good? Or does it destroy a cedar forest merely to produce its own tempting food?

The *Daedalea* genus is among the most prolific of the fungi of the world. Of these, none are more so than the species *Quercinua*. It commences on oak stumps, logs, and dead spots on living oaks as a white pudding, but when it takes form it has a pure white top and base resembling coral. When old and dead, it is black. In some forms it spreads out like a big white plate, again it is spiriform and often it is a thick, heavy triangle. It is as hard as the oak itself and very difficult to remove. *Confragosa* is thinner, hanging on dark limbs, often so white on top that it glistens far through the forest, but a beautiful seal brown below. It is a thin fungus, easily broken. *Juniperinus* attacks red cedar stumps.

INONOTUS HIRSUTUS IN ADULT STAGE GROWING ON AN OAK NEAR FORKED RIVER, N. J.

Ascending from the cedar swamp to the pine forest on the adjoining highland, there was no difficulty in locating a number of specimens of the pine fungus, *Porodaedalea Pini*. Botanists refer to it as a destructive parasite of coniferous trees in Europe and America. As I approached salt water the specimens grew larger and larger in size (the same is true of all other species) until on the very edge of Barnegat Bay, I located the largest of the type ever seen in this part of the world at this writing. One can easily find hundreds of trees destroyed by this species, but as lumber is now of very high value and in great demand, the ax is likely to accomplish a swifter desolation. The beautiful Forked River forests are already beginning to show the desolating influence of the ax and sawmill. The pine has many fungous diseases. S. T. Dana, of the United States Forest Service, has just reported on a *Septoiea* which is attacking and destroying the white pines of New England. He reports that in some places 20 to 30 per cent of the trees are affected by this leaf blight. Another formidable bracket fungus affecting pines is the *Fomes Ungulatus*. The bark is scourged by a flat leaved fungus, a *Merulius*, and a white paint-like fungus, a *Corticum*, spreads out on it and under it on the inside of the bark and on the wood and in the cracks. A rather beautiful, but small, blood-red bracket, *Claudopus nidulans*, attaches to dead pines. The troubles of pines and other coniferæ, however, do not end here. Species too numerous to mention attack them. In all the southern States the government Forest Service is concerned with "bluing," a fungus of the genus *Ceratostomella*, which attacks lumber as soon as trees are sawed, staining and destroying its value.

TRAMETES UNICOLOR ON A WHITE OAK TREE, FORKED RIVER VILLAGE, N. J.

PIPTOPORUS SUBEROSUS WHICH DESTROYED WHITE BEECH TREES NEAR EATONTOWN, N. J.

DAEDALEA QUERCINUA NEAR FORKED RIVER, N. J.

PORODAEDALEA PINI ON A TWO-LEAVED YELLOW PINE NEAR FORKED RIVER, N. J.

FUNGI DESTROYING EASTERN FORESTS.

* Contributions from the New York Botanical Garden, by William Alphonso Murrill, assistant director, etc., engaged in the revision of the nomenclature of the fungi, to whose disinterested assistance I am indebted for the revised names of the species herein mentioned.

had hundreds of small brown pileate brackets, resembling accurately a macaroon. They attack living oaks, cherry trees, etc., wherever a dead spot gives them a foothold, soon destroying the whole tree.

Another common bracket afflicting and destroying living oaks, and other deciduous trees, is the *Trametes unicolor*. It is a beautiful shelf, white above and golden yellow like a sunflower below. Indeed, the largest specimen I found at Forked River, twice the size of any museum specimen, due to heavy moisture of the sea-coast, looked underneath exactly like a big sunflower. Its great and gorgeous white top showed for a thousand feet distant in the grove.

Pyropolyporus Robiniæ is a new name given by Murrill to a fungus which owing to varied shapes has had many names. Its importance is now attracting attention in New York and vicinity, where it is destroying, unhampered, the noble locust trees of Van Cortlandt and other parks. When it starts in a locust grove it spreads rapidly. Every locust tree of Van Cortlandt Park now has or has had one or more of these large and beautiful brackets, with greenish olive tops and golden base. I visited the estate in New Rochelle which was once George Washington's headquarters. The old mansion lies back on a high sloping lawn of immense proportions, covered with giant locusts. In every tree are one or more brackets of *Robiniæ*, some of them of huge size. Elsewhere in New Rochelle and Larchmont and on the city streets, I saw single trees and whole groves prolific in *Robiniæ*. Dr. Murrill has exploited in the Journal of the New York Botanical Garden, of which he is editor, several diseases which are destroying park trees, with no present remedy in sight. Among these are "numbers of dead and dying chestnut trees," and "the plane trees in the garden grounds which have been seriously attacked by a fungous disease which causes the young twigs and leaves to die and change color as if scorched by fire."

One of the most common and most beautiful and destructive brackets is the artist's fungus of art and commerce, *Elfvingia megaloma*. Artists find its smooth white, hard base good to paint upon, resulting in a picturesque object for the mantelpiece. Woodworkers seek it with which to make brackets, and there is at least one shop in New York where this and other hard species are converted into ornaments for the drawing room. The top of the bracket is variable in color. On some logs and stumps the top varies from a dull ocher to a rusty red. On dying trees the top is more of a lead color. One form is as thin as a china platter, resembling it and round in form. On dying trees it is thick and heavy. On a huge cherry tree on Jerome Avenue, New York, there is at this writing, a specimen two feet long and triangularly as thick. It is a foot wide across the sloping roof. Everywhere from Forked River to Westchester I have run across this species, finding no two specimens alike in form. All of the visible part of a fungus is called by botanists the plant's fruit. Thus Murrill in his "Contributions," says of *E. Reniformis:* "In every case the fruit bodies of the previous years were dead with the latter growths below—only the last year's growth in each case being alive." It is apparently true of other species also, that only the outer ring is alive. As a matter of fact all that is visible of a fungus is its last stages, the effort it has put forth, or fruit, to reproduce its kind. Prior to that it has sent its thread-like growth (mycelium) into tree or soil, a matted or felt-like growth, that has exhausted its food and worked death to the object attacked. Upon this basis, the beautiful bracket or "toadstool" is quickly erected as reproductive energy, and as a triumphant announcement in nature that the tree or soil is conquered.

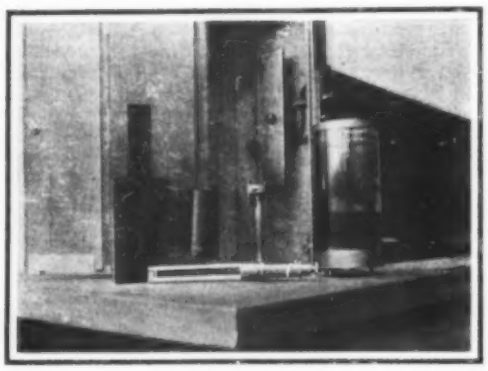
The parasitic forms of the fungi, or those existing on living trees or organisms, are generally most interesting because they are destructive of the most valuable features of woodlands—the living trees and shrubs, their foliage and branches. The saprophytic fungi, or those which obtain food from dead organic substances, from the dead spots of living trees, dead trees, stumps, logs, branches, lumber, fences, etc., are only less interesting because they are in a sense, mere scavengers. Space will not permit further descriptions of species. Let all who read get down the axes and extend their lawn trimming to the forest just across the meadow. The farmer wonders that so many of the monarchs of his forest have fallen. Let the State and nation employ experts who can enlighten him and show him how to preserve his deciduous and coniferous woodlands. "Tree doctoring," as conducted by official "foresters," is absolutely worthless and a waste of good time and money. Trees bearing fungi must be destroyed root and branch. They cannot be doctored, because the mycelium of a fungus cannot be killed by any known fungicide.

Is a noble forest tree, its body attacked by one or more species of the fungi, its leaves by other species and its branches by still other species, less to be cared for than a tomato or a lily? Is it right for our forests to rot down, unprotected by owners, the State or the nation? Why have the State and national forest commissions no experts on forest fungi, no statisticians, few data? Owners, State and national boards, see thousands of dead trees and take no action, except on fires or propagation. Why bother about propagation until the thousands of types of insidious attackers of deciduous and coniferous growths are wiped out? The fungus may be either perfectly and deliciously edible or horribly poisonous and murderous or harmlessly woody in fiber. Of the two, the poisonous fungus is least harmful because it only drains the soil of the few chemical elements that produce poison. If edible, it has exhausted the immediate soil or tree of every iota of its elements which produce food. Wherever a fungus lives it absorbs every particle of nutriment that would otherwise go to support the tree or plant on which it lives. If on a tree, it takes off every element for itself that goes to make wood fiber and its brackets, or fruit, become hard and wooden like the tree. If on a plant, it draws every element to itself that the plant would absorb for its own life. There are thousands of items about the fungi but space will permit of mention of but few of them. After due consideration, one is tempted to conclude that all plant and tree life was originally created solely as food for the fungi.

KORN'S NEW TELEPHOTOGRAPHIC SYSTEM.—I.

SENDING PICTURES BY WIRE FROM PARIS TO LONDON.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN



THE RECEIVING END WITH DARK BOX REMOVED. TRANSMITTING FILM SHOWN AT THE RIGHT.

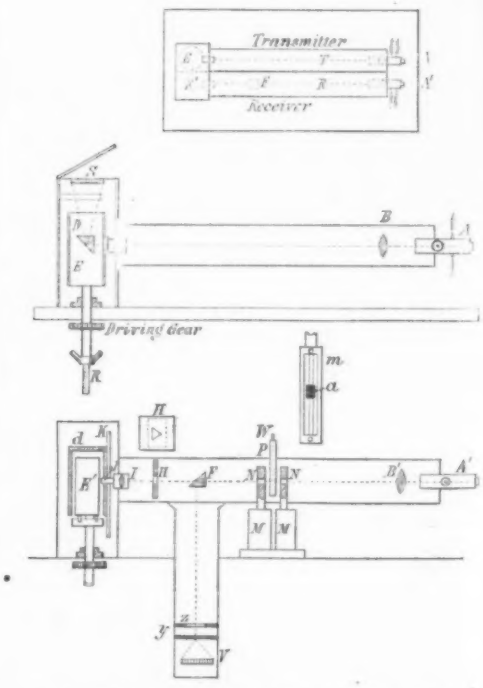
WE had occasion not long since to make a visit to the offices of the Illustration, which is one of the principal illustrated weeklies of Paris, in order to see the new photo-telegraphic apparatus (Dr. Korn's system) which is in operation at present between this post and a similar post in London. The latter station is located in the offices of the Daily Mail. During the Franco-British Exposition it has been transferred to the pavilion which is occupied by that journal. It will thus be seen that the question of sending newspaper views by wire has entered a practical stage. The present pair of apparatus has been constructed by the Carpentier establishment, and although it is now in running order for some months past, no detailed description of it has been published, in France or elsewhere. We are now able to show the different working parts of the apparatus and also to speak of some of the questions relating to the practical transmission of photographs which have not been brought out hitherto. The Paris station is in charge of M. Jules Chatenet, who has shown great skill in making the different adjustments which the system requires, and in carrying out the transmission of the views. The present apparatus is connected with London over the land telephone line and a telephone cable in the Channel. It has also been connected with a similar post in Berlin.

A very curious effect was recently produced on a portrait transmitted over the Paris-London line. There is considerable induction upon this line from other wires which run upon the same poles. And in this particular instance the effect of the currents in the neighboring telegraph lines was distinctly marked in the image. The photograph is reproduced herewith and it will be observed that each of the parallel lines of the image is made up of dots and dashes of the Continental Morse alphabet, which can easily be read. In the present apparatus the transmitter and receiver are mounted side by side in a compact form, and the whole apparatus is inclosed in a series of wood chambers. The latter are readily accessible by means of a set of doors which allow the principal parts of the apparatus to be reached and adjusted. The main part of the apparatus is mounted on the top of a substantial wood table, with the exception of the part

A CURIOUS EFFECT OF INDUCTION.

The picture is made up of dots and dashes inductively produced by a parallel telegraph line.

KORN'S NEW TELEPHOTOGRAPHIC SYSTEM.



PLAN AND SECTIONAL SIDE VIEWS OF THE TRANSMITTER AND RECEIVER.

which relates to the compensating selenium cell, this latter being placed in a vertical wood column under the table. On the lower shelf are placed the motor, which is of a good size, and the different rheostats for regulating the different parts of the circuit.

The method of mounting the principal parts of the apparatus will be seen by referring to the diagrams. In the plan view of the instrument are observed the two long cases placed side by side, the chamber *T* being used for the transmitter and chamber *R* for the receiver. For the transmitter, the light comes from a lamp *A* placed at one end, and passing through the chamber falls upon the cylinder *E*, which contains the photographic film to be transmitted. In like manner the receiver has a similar lamp *A'*, which sends a beam upon the cylinder *E'*, upon which is wrapped the sensitive film for reproducing the photograph according to the current impulses coming from the distant station.

The further details of the transmitter will be observed in the sectional view of the apparatus. At *A* is a Nernst lamp which is mounted inside a pair of telescoping brass cylinders in order that its distance from the lenses may be adjusted. The main lens *B* directs the light in a beam to the other end of the apparatus. Here is mounted the glass cylinder *E*, around which the photograph in the form of a positive film is wrapped. The beam of light passes through a small lens *C* which is mounted in a sliding tube and the light is brought to a focus at the surface of the film. The beam after traversing the film is reflected upward by the total reflection prism *D*, and then falls upon the light beam to a greater or less extent according to the strength of the current. This current, however, depends upon the amount of light which falls upon the selenium cell of the transmitter, according to the light or dark places of the original film, so that the beam of light which falls upon the cylinder *E* will depend upon the character of the transmitting film, and we will thus have the photograph reproduced upon *E'*.

In order to produce the proper value of the light beam upon the receiving cylinder, Dr. Korn found it necessary to make two separate adjustments. First, the electro-magnetic shutter must be so adjusted that its deflections correspond as nearly as possible to the current strength in the line, so as to give a movement which is proportional to the values of the transmitting film, and second, this effect is further adjusted by means of the screen *H*. It has a triangular opening which is entirely covered by the shadow of the aluminium shutter when there is no current in the line. When the screen is shifted according to the current, it uncovers a part of the triangular opening so as to admit the light to the lens *I*. By these two methods Dr. Korn obtains a beam of light which corresponds very nearly to the values of the original film.

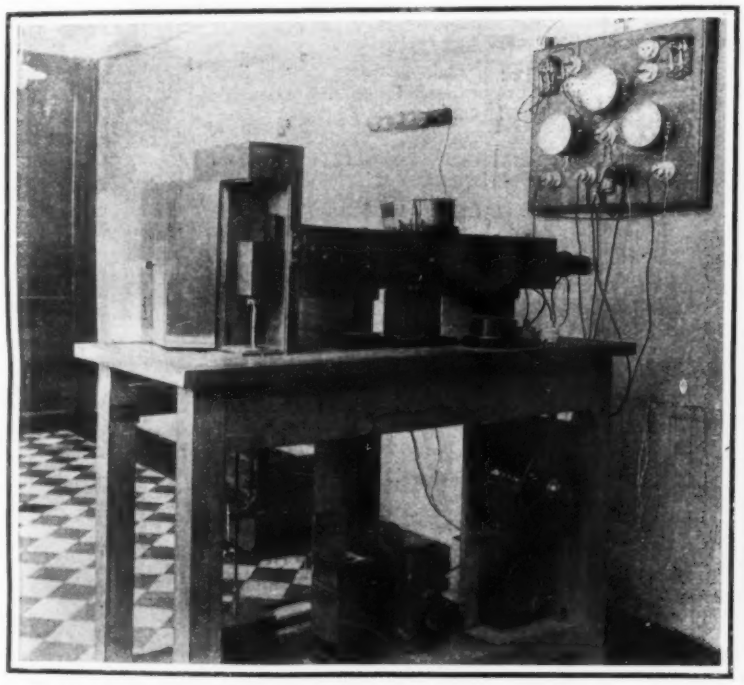
The success of the present apparatus depends in a large measure upon the use of the compensating method which was discovered by Dr. Korn. A great drawback in the use of the selenium cell for image-transmission work lies in the inertia of the cell. When light is made to fall on the cell, its resistance is lowered, but this action is not instantaneous and it requires a certain time for the cell to reach the final current in the receiver responds almost instantly to the variations of light on the selenium. In order to produce the necessary difference between the cells, the main cell is chosen so that it has a small inertia and a corresponding high resistance, while the compensator has a large inertia and a low electric resistance. These qualities depend upon the thickness of the layer of selenium in the cell, the thin layer having a less inertia and the thick layer a greater inertia, because the action of the light is slower in penetrating the mass.

In practice, the electro-magnetic shutter *W* at the transmitting end (as it is not otherwise in use) is employed for the compensator. For this purpose the two cells, one being the main cell *S* and the second the compensating cell *V* placed below, are lighted at the same time. Cell *S* is lighted directly by the film. The resulting current acts upon the electro-magnetic shutter *W* of the transmitter, and the light beam is uncovered accordingly. The beam is sent down upon cell *V* by means of a reflecting prism *F*. Thus both cells are lighted at practically the same time and in the desired proportions. It is found best to light the cell *V* at a somewhat different degree from cell *S*. The combined current from the two cells is sent into the line in order to work the receiver at the other end.

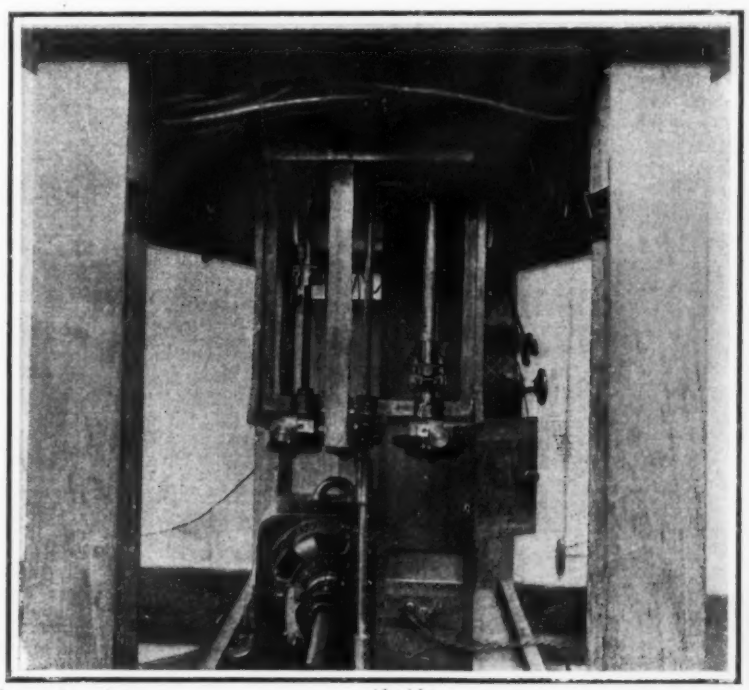
(To be concluded.)

FORMIC ACID AS A SUBSTITUTE FOR ACETATE OF LIME.

CONSUL-GENERAL ROBERT P. SKINNER, of Marseille, furnishes the following information relative to the



APPARATUS OPEN AT THE RECEIVING END, SHOWING DARK BOX CONTAINING FILM CYLINDERS.



VIEW SHOWING DRIVING MOTOR AND SCREW SHAFTS ON WHICH THE CYLINDERS ARE MOUNTED.

KORN'S NEW TELEPHOTOGRAPHIC SYSTEM.

selenium cell *S*, which is placed in the top of the case. The cylinder *E* is mounted upon a screw shaft *R* so that as it is rotated it will move upward. Thus the beam of light is made to cover spirally the whole surface of the cylinder.

In the receiving half of the instrument we have the lamp tubes *A'*, which are identical with the former, also the lens *B'*, directing the beam through the electro-magnetic shutter *W* and the screen *H*, to the lens *I*, by which the beam is focused upon the receiving cylinder *E'*. This latter cylinder is designed to receive the sensitive photographic film, and it is mounted in the same way as a transmitting cylinder upon a second screw shaft so as to allow the point of light to cover the whole surface of the film for reproducing the image.

Two of the essential parts of the apparatus are the electro-magnetic shutter and the compensator. The former is shown at *W*. It consists of a strong electro-magnet *M M*, whose poles *N N* project upward inside the case, and are perforated so that the beam of light can pass through them. Between the poles is placed a sensitive device *P*, which is shown on one side in further detail. It consists of a brass frame *m* upon which is mounted a pair of platinum wires. The latter carry at the middle point a small square of aluminium *a*. When the frame is put in place between the magnet poles, the aluminium piece acts as a screen for the beam of light. The current from the line is made to pass through the platinum wire, while the electro-magnet is excited by a steady flow of current from a local battery. According to the variations of the current in the line, the wires and shutter are deflected more or less from the central position, in the manner of a galvanometer. The shutter thus uncovers the value of the resistance. In like manner, when the light is removed, the cell does not respond at once, but requires even a longer time to return to the original state. In some cells this time is quite long, but in others it is reckoned in fractions of a second. This action prevents a clear transmission of the image unless some means are found to overcome it. Dr. Korn was quite successful in overcoming the inertia of the selenium cell within the desired limits by the use of a second or "compensating" cell.

At the time of publishing our preceding account of Dr. Korn's system, the compensating method was not clearly understood, but at present we have been able to secure some information upon the subject, given by Dr. B. Glatzel, of Berlin, who is in charge of the photo-telegraphic station located in that city. A full account of the compensating action will be given in next week's issue of the SUPPLEMENT. In general, the compensating effect is secured by mounting the main cell and the compensating cell in a circuit containing a corresponding pair of resistances, so that the whole is connected in the manner of a Wheatstone bridge. The electro-magnetic shutter occupies the position of the galvanometer of the bridge in such manner that there is no current flowing in it when the cells are in the dark, these being connected in opposition. If the two cells were exactly alike, when lighted there would be no change in the conditions, because their effects are opposed. But as the compensating cell is of a different character from the main cell, when both are lighted their effects are different; they will not oppose each other exactly and a current is allowed to flow. On account of the opposition of the cells, the inertia of the latter is cut down to a very small amount, and the

decline in the imports into France of acetate of lime, and the reason therefor:

There are about 25 plants in France where wood is carbonized in retorts, with recuperation of acetates and methyl alcohol. This number might be increased, as there are numerous wooded areas where there are no plants, but the chief producers of French acetate of lime deem the creation of new establishments unlikely for the present at least; nor is it any more likely that existing plants will augment their production, for the reason that no market would be found for the output.

Importations of acetate of lime have decreased to commercial zero, and the manufacturers thereof fear that before long they will be forced to seek a foreign market or reduce the scale of their operations. This situation is the consequence of the recent invention of a new material which, within two years, has become a severe competitor of acetic acid (which is derived from acetate of lime), and which has replaced it in many industries. This new product is formic acid, and is manufactured from coke.

It has come within the knowledge of French manufacturers of acetate of lime that important plants for its production have been established recently in Brazil, Japan, Australia, Chile, Canada, and Hungary, but unless their owners are prepared to find an outlet for their product at home, their prospects for commercial success would appear to be doubtful.

The second product of wood carbonization, methyl alcohol, is imported into France in fair quantities, for the purpose of denaturing ethyl alcohol, but this business, too, seems to be somewhat precarious, and should the proposed reduction by the State of the

amount to be used be authorized it would tend to terminate importations, as the domestic production of methyl alcohol would be sufficient to cover the reduced requirements. On April 1, gray acetate of lime was quoted in this country at 47.50 francs per 100 kilos ($9.17 per 220 pounds).

ENGINEERING NOTES.

Plans to lengthen the docks between 26th and 38th Streets, South Brooklyn, were laid before the Sinking Fund Commission by Dock Commissioner Spooner. Each of them would be lengthened by 280 feet. The shortest is now 943 feet, and will be, if the plan is completed, 1,223 feet. The longest pier is now 1,551 feet long and will be 1,831 feet. This will make the longest set of docks in the world. The Commissioner declared that the improvement will not be costly, as the most serious item would be the expense of dredging.

The decision of the Herts County Council to tar fifty miles more of the roads under its control, in consequence of the success of previous trials, appears to indicate that the use of tar on roads will, at any rate for some time to come, be the best means not only of minimizing the dust nuisance, but of preserving the roads. It is particularly worthy of notice that in the report of the Highway Committee of this council the fact that the tar on the surface keeps the bed of the road dry is dwelt on as an element in the preservation of the roadbed. It shows that if highway authorities would be more careful to keep the sides of roads open and clear, so that the rain water could run off the surface quickly, they would save the use of repairing material and have better highways. Many highway authorities pile on new material, and take no trouble to have the roads well drained, a course which is extravagant in the interest of ratepayers and minimizes the utility of the highways themselves for those who use them.

Messrs. Hawthorn, Leslie & Co., Ltd., launched recently a new vessel for Capt. W. R. Lundgren, of Gothenburg, for the Swedish South African Line. Notwithstanding that the operation had to be carried out by apprentices, owing to the strike of the shipwrights, the whole ceremony passed off without a hitch. Miss Helen Browne, daughter of Sir Benjamin C. Browne, D.C.L., the chairman of the builders' company, performed the christening ceremony, and named the vessel "Indianic" as she left the launching ways. The "Indianic" is the sixth vessel to be launched for the same owner from the Hebburn yard, and is the first of two sister vessels now building. Her dimensions are 393 feet over all, by 52 feet beam, by 28 feet 6 inches depth molded, and she has been built under special survey to Lloyd's highest class. She will be capable of carrying a dead-weight cargo of over 7,800 tons in five holds, and the five large hatches are well provided with derricks and powerful winches. The St. Peter's department of Messrs. Hawthorn, Leslie & Co. are constructing the propelling machinery. This will consist of a set of triple expansion surface condensing engines with cylinders 27 inches, 45 inches, 74 inches by 48 inches stroke, supplied with steam by two large main boilers and one auxiliary boiler, all working at a pressure of 180 pounds, with Howden's forced draft arrangements fitted to the two main boilers.

Watershed patrol to discover any conditions affecting seriously the quality of a municipal water supply is generally recognized to be necessary, but very few water commissions know just how the inspection should be conducted. For this reason there is printed elsewhere in the Record an article on the subject by Mr. Theodore Horton, chief engineer of the New York State Health Department, outlining the general methods to be followed. New York has taken an advanced position in this field of sanitation by providing assistance to any water commission desirous of organizing an efficient patrol. At the request of such a board, a trained inspector from the State Health Department will make a detailed examination of the catchment basin and prepare a full set of rules, adapted to the local conditions, to govern the men in conducting such a patrol. Such aid is decidedly needed, for many boards would gladly order systematic inspection if they knew how to do so, and a little local pressure from physicians could make other boards act. As Mr. Horton points out, however, inspection cannot accomplish everything, and it might be well to supplement it with the system of voluntary inspection adopted by Mr. R. A. Cairns, city engineer of Waterbury, Conn. He has posted notices about the drainage area from which the water supply of that city is drawn offering a reward for promptly notifying him of any unsanitary conditions that may be detected. Such notices are not only constant reminders of the danger that may result from the contamination of the supply, but also serve to stimulate a general interest in preventing the presence of sources of pollution. The actual cash outlay in paying rewards is probably trifling and not to be compared for a moment with the advantages it offers.—Engineering Record.

ELECTRICAL NOTES.

Following the American practice an electric company in the south of France employs aluminium wires in part of its system. The wires have a sectional area of 110 square millimeters (0.176 square inch) and carry triphase alternating currents of 50,000 volts tension. Although the resistance of an aluminium wire is nearly twice that of a copper wire of the same section, it is much less than that of a copper wire of the same weight. Hence the substitution of aluminium for copper makes it possible to use lighter wires and thus facilitates installation and greatly diminishes the strain and wear of wires and supports. Aluminium also offers the great advantage of being entirely unaffected by moist air. The average current price of copper wire is 2.05 francs per kilogramme (18 cents per pound), while the price of aluminium wire containing a little copper is 3.50 francs per kilogramme (31 cents per pound).

The increasing application of electric drive in iron and steel works is due partly to the economy in transmission and distribution, partly to its reliability and partly to the ease and facility of control. Electricity offers also, in many cases, the most efficient and elastic system of power transmission. It requires simply a few properly insulated wires for the transmission of great quantities of power for long distances and with a small percentage of loss. A part or all of the load can be easily and quickly changed, cut off or thrown on without injury to the system. These features permit the centralization of the smaller generating stations required by other systems, the averaging of the intermittent and varying loads and effect a generally increased production. This means a great reduction in the cost of power and in the capacity of the stations. Generally a central power house need only have from 25 to 33 per cent of the combined capacity of the auxiliary motors.

Mr. C. L. Clark, chairman of the Edison medal committee of the American Institute of Electrical Engineers, issues in the Proceedings of the institute an interesting statement as to the terms of the new deed of gift governing the award of the medal. It is as follows: An important change has been made in the conditions under which the Edison medal is hereafter to be awarded. The Edison medal was founded upon the initiative of an organization, known as the Edison Medal Association, composed of old associates and friends of Mr. Edison, who subscribed a trust fund for that purpose, under an indenture dated February 11, 1904, and entitled "Deed of Gift Creating the Edison Medal," whereby the institute engaged annually to award the medal "to such qualified student as shall have submitted to the institute . . . the best thesis on record of research on theoretical or applied electricity or magnetism." No student whatsoever having entered in competition for the medal, although wide publicity had been given to the provisions of the deed by means of appropriate notices, repeatedly sent broadcast to institutions of learning where electrical engineering is taught, the institute became convinced that: (1) the foundation had practically been demonstrated to be a dead letter; (2) the conditions of award under the deed did not properly meet existing circumstances; (3) or insure a general competition by students representing any substantial number of the qualified institutions of learning; (4) criticism of the Edison medal foundation had become general on the ground that it was unusual to award gold medals in the manner provided to young students at the beginning of their careers; (5) the terms of the deed ought to be changed so as to place the award of a medal in the name of Edison on a plane comparable to the award of the John Fritz medal, the Bessemer medal, the Rumford medal, and others of equal renown, whose recipients have been the foremost scientists, philosophers, and engineers of their time, and (6) the award ought to be made to bear a distinct relation to achievement in the electrical field. Thereupon, the Edison medal committee of the institute was directed, in the spring of 1907, if possible to obtain such change in the deed as to make the award dependent upon "meritorious achievement" in the electrical field. Owing, however, to the legal requirement of obtaining the assent of the 24 surviving and widely scattered members of the executive committee of the Edison Medal Association to the change, and their signatures and seals to a deed embodying the same, it was not until March 26 of the present year that the change was finally consummated in a new deed entitled "Amended and Substitute Deed of Gift Creating the Edison Medal." By the terms of the new deed, the Edison medal is no longer open for competition, but it is to be awarded "for 'Meritorious Achievement' in Electrical Science or Electrical Engineering or the Electrical Arts," thus placing the award on the high plane where the institute and the Edison Medal Association deem it properly belongs. The award is limited to a resident of the United States and its dependencies or of the Dominion of Canada.

TRADE NOTES AND FORMULÆ.

Varnish for Foundry Patterns.—15 parts of shellac, 5 parts of Manila copal and 5 parts of Zanzibar copal, are melted, in a suitable vessel, with the aid of steam and stirred for four to six hours. 150 parts of the best potato alcohol are added and the whole heated for 4 hours, to 185 deg. F. Finally mix with yellow ocher.

Molding Mass of Gutta Percha.—*a*. Gutta percha 4 parts, bone black 2 parts. *b*. Gutta percha 4 parts, bone (horn) dust 2 parts. *c*. Gutta percha 3 parts, bone dust 1 part, pipe clay 1 part. The mixing of the constituents is effected by kneading, warm; by incorporating mineral and earth pigments, different colored masses may be obtained. To neutralize the unpleasant odor, powdered orris root or a volatile oil (say oil of rose geranium) may be mixed with the mass.

To Bleach Gutta Percha with Chloroform.—1 part of finely shredded gutta percha is treated with 20 parts by weight of chloroform, until solution is effected. Then 0.5 per cent of water is added, actively shaken, allowed to settle and as soon as the fluid has separated into two strata, the clear liquid is run off into a distilling apparatus and the chloroform distilled off. The purified gutta percha remains in the form of a bubbling white mass and is rolled out warm into thin rods. It is used, softened in hot water, for filling cavities in teeth and for the production of molds of delicate patterns.

Ammonia and Alum as Fire Extinguishers.—Spirit of sal ammoniac is a good fire extinguisher. (Drog. Rundschau.) It should always be kept ready for emergencies and in an airtight receptacle. In a recent fire the vapors from a vessel containing 225 liters of benzine ignited and the room became a sea of flame. Barely 7 liters of ammonia extinguished the fire almost immediately, so that in a few minutes the workmen could enter the room, where they found the iron benzine receiver nearly uninjured. Another good preparation for putting out fires is a saturated solution of alum in water. The alum spreads itself in a thin layer over the burning particles, thus shutting off the air and stopping the fire.

A Test for Gilding.—Hold the article to be examined in a pair of tweezers, sprinkle it first with alcohol and directly after with ether, place it for a minute on blotting paper and then in a clean, dry test tube. Pour over the article, which is to weigh 0.1 to 1.5 gramme, 0.5 to 10 cubic centimeters, according to the weight, of nitric acid free from chlorine and of 1.3 specific gravity. If the acid remains clear, allow the article to dissolve; if it is milky, pour it at once into another clean, dry test tube. If the article is gilded, tiny particles of gold will be visible in the fluid, especially on the surface and at the bottom. The reaction is so sensitive that it will clearly show the presence of 0.01 milligramme of gold on a surface of 2 square centimeters.

How to Polish White Maplewood Carvings.—To make carved maplewood moldings white when polishing, it is above all things essential that only really white maple be used, for maple is frequently offered for sale which certainly may appear white, but which was neglected after felling and consequently has acquired a grayish tinge. This will become apparent when the wood is treated, especially when it is planed and polished. To keep the cavities and carved portions in a perfectly white maplewood clean and white, take fine white wax and cut or pare it into thin shavings. Dissolve these while still soft in pure turpentine oil till a thick, pasty mass is formed. Spread some of the cold mass on a woolen rag or clean brush, and rub the article till a matt polish is obtained; then coat it, not too wet, with viscid white French polish—white bleached shellac dissolved in strong alcohol—and if this has been carefully done, there will be no danger of rough places caused by the raising of the pores. It will, however, be well gently to rub the article with very fine glass paper and then polish as usual with pure white French polish. Care must be taken that the oil used for polishing is not applied direct to the wood, but put in small quantities on the polishing balls at the beginning of the process.

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